SURVEY OF POWER SEMICONDUCTOR MANUFACTURERS

for

Nippon Kokan K.K.

Prepared by:

Semiconductor Industry Group
Dataquest

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INTRODUCTION

Digital IC development has grown phenomenally in the past decade to the exclusion of linear IC development. Increased amounts of money, personnel, and resources have been applied to digital IC technology to reduce the cost, size, and power consumption of digital products.

While digital computer chips, memory chips, and logic chips help to do the "thinking" in modern electronic equipment, other electronics are required to do something--to perform work and to control motion. This work requires linear circuitry and electronics. Linear and power ICs must get more attention and more resources to gain full benefit from digital computer chips.

The power electronics to run motors, actuators, lights, and switches in all this equipment often costs much more than the digital computer chips. Because low-cost complex power chips have not been available, equipment design engineers are frustrated in solving the problem. Modern microcircuit technology needs to make design easier and reduce costs in other parts of machines the way the computer chip has for the "thinking" part, but engineers have had to use old (often 20-year old) electronics to interface between the computer and the motors, actuators, lights, and switches.

These old electronics are circuit boards full of separate resistors, capacitors, inductors, power transistors, and so on, which are collectively called discrete components and which must be individually connected to the equipment. Billions of dollars are spent on these components annually, but they often limit the performance, cost effectiveness, reliability, and size reduction for any given type of equipment.

Many of the manufacturers of discrete components want to participate further in power electronics. They are marketing their discretes (very often new discretes such as MOS power devices, but still discretes) packaged in hybrid circuits with four or more separate discrete chips inside the package. While it is too early to know how successful such hybrids will be, it is already evident from many users that such hybrids are too expensive for motor-drive applications in computer peripherals, office products, and perhaps automobiles. A fully monolithic approach appears to be preferred.

Power electronics generally have not received attention from the microcircuit manufacturers because power electronics are used where voltages and currents (hence, power) are many, many times greater than those used by digital computer chips. The techniques and manufacturing processes used for computer chips simply cannot be used to make IC

components for such high-power applications. Hence chip manufacturers, who have devoted their resources to digital computer and logic ICs, have not developed ICs capable of handling high-power equipment functions.

SMARTPOWER SUBMARKETS

Some semiconductor companies have recently begun attempts to alleviate the large gap in IC development between very low-power computer chips and high-power ICs. Different specific technologies are being tried for different applications, but all efforts at integrating power and interfacing logic on one chip now come under the general heading of smartpower.

Three distinct categories of equipment needs have developed into submarkets for smartpower applications as shown in Table

Market sizes shown are built up from equipment needs and are smartpower opportunities which may not be all filled by new products due to limited smartpower suppliers.

Table

[redacted]

Submarket Competitors	Application	Electrical Function	Electronic Characteristics	Process Technology
Medium-Power ICs Siliconix Supertex Texas Instruments Sprague	Flat panel displays Telephone switchgear Communications equipment	Display drives SLIC and telecomm switches Line multiplexing	Up to 200 volts Up to 100 milliamperes output Up to 5 watts dissipation	CMOS/DMOS
High-Power ICs Integrated Power Silicon General Unitrode SGS Sprague Hitachi	Computer peripherals Office equipment Automobiles/vehicles Factory systems/robotics Aircraft Small appliances Power supplies Hand tools	Motor controls Motor drives Solenoid drives Actuator drives Power supply control Servo systems Light/relay switches Power regulation Power supervision Power multiplexing	Up to 400 volts Up to 10 amperes output Up to 50 watt dissipation	Bipolar at present BiMOS for future
Very High-Power Discretes Motorola International Rectifier Siliconix Siemens RCA General Electric Ixys Eupec	Factory systems Power supplies Power tools Television/CRT terminals	Large motor drives Power supply outputs Deflection circuits AC speed controls	Up to 1,500 volts Up to 100 amperes Up to 200 watts dissipation	Hybrids; segment not likely to be monolithic

Source:
Dataquest
May 1986

MARKET SUMMARY

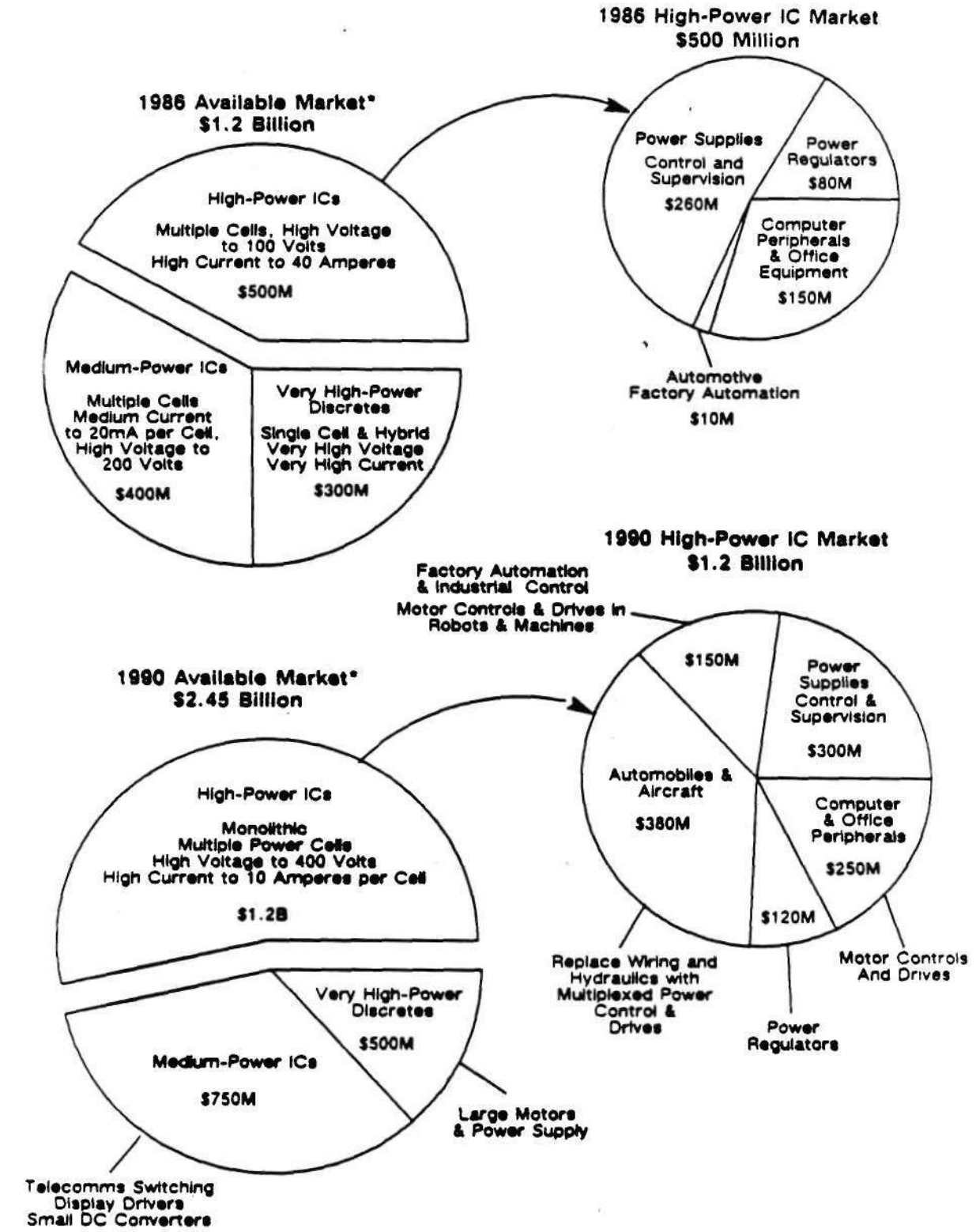
The following figures C1 and C2 graphically outline the growth of the three primary segments of the smartpower market. In Figure C1, from 1986 to 1990, the total smartpower market is expected to grow from $1.2 billion to $2.45 billion, a compounded annual growth rate of 17 percent. However, the high-power IC market is expected to grow from $500 million in 1986 to $1.2 billion by 1990, which represents a 25 percent compounded annual growth.

By 1990, the market will remain basically the same: power supplies, computer periperals, power regulators, automobile and aircraft, and factory automation equipment. However, by 1990 the primary market will shift to automobiles and aircraft, which will comprise roughly 44 percent of the high-power IC market. This dramatic shift is due to the fact that each of the 30 million cars, trucks, buses, and other vehicles made each year ultimately needs between $25 and $100 of smartpower devices for dashboard functions, engine, fuel, and steering controls, and the "extras" of mirror, seat, window, door lock, air, and other controls. Lack of supply is the limit to shipments into this market.

Markets for high-power ICs will become very large by 1995 (see Figure C2). The markets are expected to be divided into seven major categories: power supplies and regulators; automobiles and aircraft; factory automation and industrial control; computer peripherals; consumer appliances; lighting; and television deflection circuits. The automobile and aircraft market will remain the largest single user of smartpower devices, controlling more than 40 percent of the market.

Figure C1

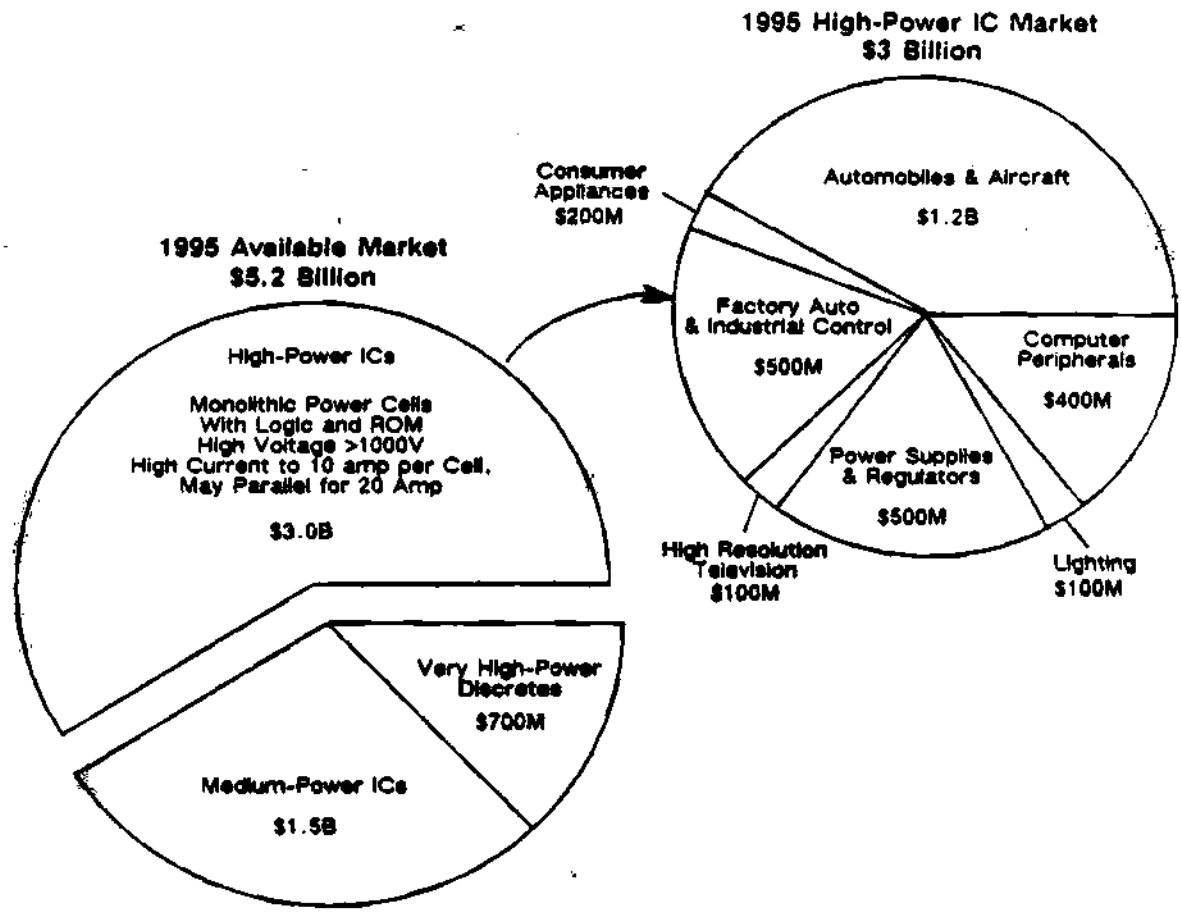
1986 AND 1990 SMARTPOWER MARKET



*Some "Available Market" is not/will not be served due to limited suppliers.

Figure C2

1995 SMARTPOWER MARKET



Notes to Figures C1 and C2:

1. Automotive High-Power ICs assumed to be captive manufacturers.

2. Computer Peripherals will become single-chip equipments (Example: Optical and Magnetic disk drives will have power and logic on one chip—technology now being developed at Integrated Power).

3 Consumer applications will be new markets starting to develop—technology to lower costs now being developed at Integrated Power. However, no speculation at this time on the profit margins of this business or Japanese involvement.

4. Factory Automation, Robotics, Industrial Controls will continue to need specialized custom/semicustom power ICs with on-board logic and ROM abilities; target markets for Integrated Power.

5. All *market* numbers represent what could be done if sources of supply existed to serve the market; i.e., the numbers are positions or "slots" available.

The technology exists, or will exist, easily for the applications. The limitation is/will be resources of the suppliers to develop and produce the products.

SUMMARY OF HIGH-POWER IC TREND

The following is a list of the major trends that are expected to occur as a result of high-power smartpower ICs. The high-power IC technology will:

- Replace the older, expensive, inefficient, power discrete circuit boards in computer peripherals and office equipment with efficient modern ICs at low cost. As an example, the disk drive will have a single chip for its electronics.

- Replace the heavy wiring harnesses in automobiles and aircraft with lightweight, small, multiplexed, coded control systems at low cost.

- Replace the bulky hydraulic systems in robotics, aircraft, and factory automation equipment with simpler electronic control-and-drive systems at low cost.

- Replace slow, unreliable electromechanical components in industrial and process control equipment with fast reliable electronics at low cost.

- Change the shape, cost, and reliability of actuator equipment throughout the 1990s by the placement of ROM capacity (memory), along with algorithm control (simple computer functions), on the same chip as high-voltage (1,000 volts), high-current (10 amperes) power cells.

- Move high-power ICs into household appliances, lighting controls, and consumer entertainment equipment. (By 1990 costs will be reduced so that this move into consumer products is feasible.)

KEY ISSUES OF HIGH-POWER SMARTPOWER

Integrated Power understands and anticipates both users' needs for high-power, monolithic smartpower devices and the constraints of the technology. The following are the key issues faced by users when they review the high-power smartpower suppliers. Integrated Power addresses these issues with innovative solutions that meet or exceed the smartpower users' needs:

- No user can seriously consider high-power monolithic ICs unless they provide power packaging for the chips. Major considerations that must be met are:

  - Reliability
  - Cost
  - Usability

  Integrated Power has a broader range of packages for power ICs than any other manufacturer, and it is developing more.

- No user can seriously consider high-power monolithic ICs unless they can reduce heat and increase efficiency. Reduced heat and increased efficiency mean:

  - Greater reliability
  - Lower cost
  - Higher performance

  Integrated Power's R&D physics program has targeted major improvements in a chip's power-handling ability.

- No user can seriously consider high-power monolithic ICs unless they provide process and manufacturing technologies that address the needs of the equipment manufacturers.

  Integrated Power's developments in bipolar power and logic combinations, MOS power and CMOS logic combinations, and mergers of bipolar and CMOS, either provide or will provide innovative solutions to complex applications and cost issues.

- No user can seriously consider high-power smartpower ICs, in the present state of the market, unless many resources are applied to circuit design because so few products currently exist.

  Integrated Power has attracted many design engineers, and it is backing its custom and proprietary design capability by developing a cell library, a mask-configurable technology, and a CAD software system to provide fast delivery of application-specific products. The company has already designed the broadest range of power supply ICs, the broadest range of motor-drive ICs, and the broadest range of power-regulating ICs available.

A COMPANY-BY-COMPANY LOOK AT THE 8 SMART POWER MANUFACTURERS
- Applications
- Technological Approaches

GE/RCA

At this time GE and RCA are not fully integrated therefore the two firms are listed separately.

RCA

Technological Approach: To compile the best features of MOS & Bipolar technologies for high-voltage applications. (i.e. >200 Volts). Their product is called COMFET (Conductivity-Modulated FET - a new class of power switching semiconductors).

Applications: Switching Power Supplies (at frequencies < 30 KHz); Brushless DC Motors (to switch the voltage on the windings); Large motors (per reduced heat consumption; heat-handling factors); auto ignition systems (per reduced base-drive current dissipation versus bipolar transistors); other applications (200-500V, 1-to-20-A range): Lamp Ballasting; Programmable Controllers; Ultrasonic Transducers, Solid-State Relays, Off-main Switching Power Supplies.

GE

Technological Approach: GE is concentrating on customized hybrid solutions for buyers with application-specific devices (and not standard ICs for the commodity market). GE's IGT (Insulated Gate Transistor) reflects GE's approach. IGT packaging consists of a power hybrid with the following:

(i) 2 insulated gate transistors
(ii) 2 fast-recovery fly-back diodes (FBDs)
(iii) 1 power IC (i.e., a high-voltage IC)

Applications: 1) Industrial Machinery, Process Control Equipment and Power Conversion Equipment. 2) Automotive Electrical /Electronic Control Circuitry.

INTERNATIONAL RECTIFIER

Technological Approach: Custom Hybrids, Hybrids with strong movement towards building-blocks (standard monolithic parts). Efforts are focused on Silicon-die technology (i.e. increased cell density) and packaging technology (i.e. multiple-dice devices).
IR manufactures power MOSFETs using 2 cell densities:

(i) HEXFET I : 0.5-million cells per square inch (for devices rated 100V & above)
(ii) HEXFET II : 1.0-million cells p.s.i.; for 50-V devices

INTERNATIONAL RETIFIER CONTINUED

Applications: AC & DC motor drives such as brushless dc motor controller, disk-drives, magnetic-tape drives, printers, VCRs, electronic typewriters. Hi-bridge drives for dc servo motors, stepper motors, & power supplies. Automotive applications include load "on-off" control. Other applications include uninterruptible power supplies; high-frequency welders.

SILICONIX

Packaging Approach: Custom hybrids with the goal of producing building blocks (i.e. standard monolithic ICs). Siliconix produces both medium-power (<200 V) & Very High Power (> 400 V). Technological Focus: DMOS FETs combined with CMOS. The two main technologies used are:

1) Self-isolated (SI) CMOS devices
2) Multiple-output, junction-isolated (JI) BiMOS devices that use lateral DMOS power transistors.

Applications: Electroluminescent & plasma flat-panel displays; computer printers.

SPRAGUE

Technology Approach: Standard monolithic IC products (i.e. building blocks). Currently the focus is on bipolar; evolution will be towards DMOS Power devices & CMOS logic devices although bipolar - BiMOS will maintain a large share of their product offerings.

Applications: Higher-voltage (>100 V) applications i.e. high voltage interface power drivers like high-voltage DMOS drivers, high-voltage source drivers).

SUPERTEX

Technology/Packaging Approaches: Monolithic ICs, combines high-speed CMOS ICs with DMOS power MOSFETs to produce power ICs; Supertex refers to it as a high-voltage CMOS (HV CMOS) process. The firm will not produce high-current monolithic ICs (i.e. 15-20-A power ICs).

Applications: High-Voltage drive applications include electro-luminescent, gas plasma, LCD & Vacuum Florescent Capabilities. Example products are 16-channel output drivers (for video-quality flat panel displays); 64-channel (monolithic) HVICs for flat-panel displays and continuous ink-jet printers.

SGS GROUP OF COMPANIES

Technology and Packaging Approaches: SGS's strategy calls for monolithic ICs (i.e. building-blocks), however, hybrid packages are also sold.

i)Multipower-BCD process (combines Bipolar linear, CMOS, and DMOS technologies). Features a vertical DMOS silicon-gate two-level structure.

Applications: (i) switch-mode solenoid driver (6-A, 50-V) for hammer-driving in daisywheel printers and typewriters; (ii) future applications include off-line switching supplies and telecom power converters (250-V for US market, 450-V for Europe) as well as solid-state relays and fluorescent display drivers.

ii) "Pure" bipolar vertical power process (vertical Intelligent Power, or VI Power): includes bipolar or DMOS power transistor and a mixture of CMOS & bipolar drive circuits.

Applications: High-voltage off-line power supplies, controller/drivers of automotive ignition coils, motor controllers for robotic systems.

IPS

Technology Approaches: High-power monolithic IC applications can handle up to 10 amperes with voltages up to 400 volts. IPS's spectrum of power designs also includes semicustom, full-custom, and standard high-current, and high-power ICs.

Applications: IPS devices are used in automobile and aircraft multiplex systems; electronic servo controls and computer interfaces in FA equipment and robotics; disk drives and printer control mechanisms; sensors for environmental and process controls; military equipment where older obsolete technologies need to be replaced.

UNITRODE

Technology Approaches: Unitrode's technologies are geared toward POWER MOSFETs, Power Transistors & Darlington, and Power Hybrids. The MOSFET devices are both of original design and through the license agreement with IR. The majority of Unitrode's devices are < 500 volts.

Applications: Power applications include switches, ac/dc motors and military hybrids. Unitrode's OEM contracts are targeted toward commercial, computer, space, and military applications. Currently, contracts are help with Bendix and projects for the US strategic Star Wars program. In the Power General division new products for surface mount devices used in power supply are currently being developed.

The Japanese Market Situation

Japanese manufacturers seem to be taking a low profile approach to the SMART POWER area. Currently Hitachi and Toshiba are producing SMARTPOWER IC's in hybrid packages for both internal consumption and custom order. It appears that the potential key players in this market are taking a "let's wait and see" stand until it can be determined whether or not a large market will develop for monolithic chips.

It seems the need to develop SMART POWER devices has not been fully realized yet. For example, all Epson printers still use discrete devices. Equipment needs within Japanese industry will eventually force research and development in this area. At this time Hitachi has produced DC brushless motor-drive IC for disk-drive spindle motor applications. This product's performance and reliability is limited due to operation at very high temperatures.

DATAQUEST's PRELIMINARY SMART POWER FORCAST

WORLDWIDE MARKET IN MILLIONS OF DOLLARS:

1986	$ 180
1989	$ 450
1991	$ 650

CAGR = 29%

Source: Dataquest Nov.'86

Dataquest
a company of The Dun & Bradstreet Corporation

1290 Ridder Park Drive, San Jose, CA 95131-2398
(408) 971-9000 Telex 171973 Fax (408) 971-9003

" GE / RCA "

COMPANY PROFILE

DATAQUEST
December 1987

Semiconductor
Industry
Service

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"GE/RCA"

General Electric Company
3135 Easton Turnpike
Fairfield, CT 06431
Tel. (203) 373-2431

1. Executive Summary

General Electric Company is one of the largest and most diversified industrial corporations in the world. From the time of its incorporation in 1892, the Company has been engaged in developing, manufacturing, and marketing a wide variety of products for the generation, transmission, distribution, control and utilization of electricity. In December, 1985 GE began acquiring RCA and has since proceeded to merge the two companies together. As of today a complete picture of GE's strategy is not completely clear, however, significant insights into the emerging new company are presented.

Due to the size and scope of General Electric's and RCA's business this report focuses on only the semiconductor divisions of GE, RCA, and Intersil from the time GE acquired RCA one year ago.

2. General Information

2.1 Company Background/History

On Dec. 11, 1985, the Boards of Directors of GE and RCA approved a definitive Merger Agreement whereby the Company acquired RCA through a merger. On February 13, 1986, RCA's shareholders adopted the merger agreement and GE paid $6.3 billion in cash for all of RCA's outstanding common stock.

RCA was incorporated in 1919 and engages in the manufacture and sale, distribution, lease and servicing of, and research relating to, electronic products, including color and black-and-white television receivers, videocassette recorders and cameras, color television picture tubes, display tubes and monitors, solid-state and electro-optic devices, commercial communications, meteorological and navigational satellites, a variety of electronic equipment for broadcasting and communications, and military and space electronic equipment. The firm is involved in licensing of patents and providing technical know-how relating to those products.

Since 1981, Intersil, Inc. has been a subsidiary of GE and is a supplier of advanced ICs and data acquisition products to the merchant market as well as being a captive supplier for GE. The firm's semicustom gate arrays feed into consumer, industrial, and military markets. Through Intersil, GE has moved to meet its requirement for one micron technologies in the custom circuit segment.

2.2 Management/Employees

GE - John F. Welch, Chairman and Chief Executive Officer

RCA - Thornton F. Bradshaw, Chief Executive Officer

There are basically two divisions related to the GE-SMART products and technologies. These are the Power Electronics Division managed by Larry Smart and the Integrated Power Subsystems marketing group managed by Tom Daly. Daly is also currently the acting manager for GE's HVIC gate array group.

Number of employees:

RCA Solid State Division 3,274 (Worldwide 4,700)
GE Semiconductor Business Division N/A (Worldwide 4,500)

2.3 Company Organization

The organizations of both GE and RCA are still changing from the merger. Gradually GE's operations in Syracus, NY are being phased out while RCA's operations in Rochester, NY are being dismantled altogether. Reports say fabrication equipment have been moved from Rochester to Research Triangle in North Carolina and this year the Company closed its West Palm Beach, Fla. works after moving all manufacturing to their Findlay, OH plant.

3. Financial Information (for public companies)

3.1 Financial Information

The combined annual report for 1986 is not yet available, however, the 1985 annual reports for both GE and RCA accompany this report for your reference.

3.2 Semiconductor Revenue

	RCA Solid State Division	GE Semiconductor Business Division
Headquarters	Somerville, N.J.	Research Triangle Park, N.C.
	Annual Revenue (millions of US dollars)	
n-MOS	14	100
CMOS	127	26
Linear	92	41
Bipolar	7	15
Discrete/power	101	112
Total	$ 341	$ 294

Source: Electronics Dataquest 1986

4. Operations

4.1 Lines of Business/Revenue

Percent Share of Total Profits After Merger

Power Systems	16%
Technical Products & Services	13%
Aircraft Engines	12%
Consumer Products	11%
Industrial Products	10%
Materials	10%
Major Appliances	10%
Financial Services	9%
Broadcasting & Entertainment	7%
Other	2%

4.2 Semiconductor Manufacturing Locations/Plans

RCA Fabrication Plants
West Palm Beach, Fla. (ceased production in July 1986)
Mountain Top, Pa.
Findlay, OH
Camus, WA (RCA/Sharp Microelectronics)
Kuala Lumpur, Malaysia

GE Semiconductor Business Division
Research Triangle Park, NC (GE Semi. Business Division Headquarters)
Sunnyvale, Calif. (Intersil)
Dundalk, Ireland
Singapore

4.3 Capital Spending/Research and Development

Both GE and RCA maintain major research facilities. RCA has its David Sarnoff Research Center in Princeton, NJ and GE has its Corporate Research and Development Center in Schenectady, NY.

Although it is not possible for Dataquest to obtain figures spent on research and development for the semiconductor area alone, company-wide GE budgeted $ 2,553 million dollars in 1985. Approximately one third is funded internally by GE while the balance was funded by others, principally the US government.

5. Market Analysis

5.1 Sales/Market Share by Product Category

(Please refer to the Final Market Share Estimates)

5.2 Market Share and Growth

(Please refer to the Final Market Share Estimates)

5.3 Major Competitors

In Very High-Power Discrete and SMART POWER devices GE/RCA competes against Motorola, International Rectifier, Siliconix, Siemens, and Texas Instruments.

5.4 Marketing Strategy

This year GE/RCA has taken significant steps in developing its business in the power management area of semiconductors. By combining two product departments, the Custom IC Department and the Power Electronics Semiconductor Department, GE intends to make a commitment to the integration of advanced high-voltage power electronics with low-voltage CMOS digital logic technologies. Both are now taking a comprehensive application-specific product focus with overlapping markets and customers.

In October this year GE began to implement consolidation of all their captive operations and moved their merchant business operations (including smart power) so that it can be divested. Dataquest's Industry Analysts see this strategy as an indication of GE's intentions to focus on military/defense and service type operations.

5.5 Market Leadership Positions

GE manufacturers and markets a wide range of power transistors, including bipolars, power MOSFETS and IGT insulated gate transistors. These product lines along with digital application-specific capabilities (gate arrays, standard cells and silicon compilation) are the areas where the new "GE/RCA" is pooling their strengths to either maintain a current leadership position or are working to establish that position.

In the smart power area GE forecasts an estimated $1 billion external merchant market by 1995 and has every intention of being a major supplier of that market.In particular one area to be addressed in the future is to mate the 500-volt ICs logic and power capabilities with power MOSFET's or IGT switches in thermally efficient and cost-effective packages.

5.6 Channels of Distribution

GE, RCA, and Intersil each have long established sales channel networks domestically and around the world. In addition their own sales offices, distributors, manufacturer representatives, military and government contracts are the main channels through which sales is conducted.

5.7 Major Applications

Applications of GE/RCA's smart power products include switching power supplies, DC motors, auto ignition systems, power conversion systems, process control equipment, and control circuitry.

5.8 Merchant versus Captive

It has been reported that GE intends to sell its merchant semiconductor units. This would include RCA Solid State, Intersil, and the discrete power semiconductor segment of GE's component business as one big package. GE would continue to operate and manufacture its Research Triangle plant and has shifted equipment and personnel to North Carolina to what will become a captive operation. As part of the merger of GE/RCA the firm is separating its captive and merchant operations and will then rid itself of the merchant segment. Possible buyers include Siemens, Oki Electric, and Motorola.

5.9 Export vs. Domestic

Please refer to the geographical sections in the 1985 annual reports.

6. Products and Technologies

6.1 Key Products

In the area of semiconductors GE (including Intersil) and RCA both produce similar product lines. The key product areas are as follows:

Discrete Devices
- Small signal transistors
- Power transistors
- Power Diodes
- Thyristors
- Other

Integrated Circuits
- Optoelectronics
- Linear ICs

GE

GE products include MOS-gate power, IGT (Insulated Gate Transistors), high-voltage ICs, Power MOSFETs, CMOS circuits for both linear and switch-mode power supplies, positive and negative programmable micro-power voltage regulators. GE power devices used in power supplies include high-switching-speed power MOSFETs rated from 0.5 to 40 amps, and from 50 to 500 volts; power MOS insulated gate transistors (IGTs) from 10 to 20 amps, 400 to 500 volts; bipolar signal and power transistors from 0.1 to 100 amps, 30 to 700 volts, including complementary pairs; rectifiers for both 50/60 Hertz and higher frequencies with 1.0 to 6.0 amps, 50 to 200 volts; and GE-MOV metal oxide varistors rated from 5 to 3,500 volts, 0.1 to 10,000 joules, available in axial lead, radial lead, surface-mount and connector pin packages. GE also designs and produces custom power components and subsystems for power supplies which include variations of the Company's GE-SMART smart-power modules consisting of HVICs and power MOS.

RCA

RCA focuses on the high-performance niche of the analog market, and it supplies industrial, consumer, and military segments. Its eight linear product groups are as follows: arrays; op amps; differential amplifiers; voltage comparators; power control circuits; dta conversion circuits; consumer circuits (TV/CATV, audio, radio); and special function circuits. Representative analog parts from RCA include a BiMOS precision op amp, an ultra-high-gain wideband amplifier array, an automatic fine-tuning TV circuit, and a CMOS video-speed 8-bit flash analog-to-digital converter.

INTERSIL

Intersil concentrates on data acquisition products, offering the following in CMOS technology: integrating analog-to-digital (A/D) converters with display drives (3.5 and 4.5 digits); integrating A/D converters; successive approximation A/D converters and digital-to-analog (D/A) converters. A range of linear op amps is available, including general-purpose, low-power, high-output current, ultra-low input offset voltage, and low-input bias current devices. Intersil also offers analog switchers and multiplexers, power supply circuits, temperature transducers, and voltage references.

6.2 Second Source and License Agreement

RCA has been investing about $100 million over a five year period in a joint venture with Sharp Corp. Manufacturing is scheduled to begin operations in early 1987. The joint-venture is 49% owned by Sharp Microelectronics Inc.

GE has an agreement with Westinghouse Electric Corp. and Mitsubishi Electric America Inc. to make thyristors, rectifiers, and power transistors.

In San Jose, CA, GE has a second joint venture with Silicon Compilers Inc. which provides automated foundry and design facilities using Silicon Compilers' design methods.

7. Non-Semiconductor Products Summary

This report focuses only on the semiconductor divisions of GE and RCA.

8. Dataquest Analysis

8.1 Long-term Outlook

Based on shear size and diversity of operation the "New GE" faces an overall favorable future. GE has a positive track record in terms of corporate acquisitions and divestitures. The recent merger strengthens GE's position in both commercial and military electronics.

8.2 Challenges to Overcome

GE must carefully define its mission and strategy for the electronics market place. If not handled carefully GE's intention to sell-off the commercial market operation of RCA could have a very negative effect on the moral of the RCA staff. GE must succeed in the military and consumer OEM markets as those businesses will fuel demand for its captive production.

8.3 Opportunities

GE can draw on its long experience in power technologies to become a leader in the SMART POWER IC market . GE is already a leader in the custom fabrication of power hybrids and could become a leader in monolithic versions if that approach becomes technologically feasible.

8.4 Strengths and Weaknesses (excluding technology)

Realistically at this point in time GE has no real weaknesses. However, over time GE could suffer by not fully exploring all opportunities with RCA.

GE's strength in the military electronics sector was further strengthened by the acquisition of RCA. GE has a long successful history in producing power semiconductors, including hybrid packages, for industrial consumers and motor control applications. In terms of worldwide semiconductor markets GE has not been successful in penetrating the Japanese market.

Dataquest

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INTEGRATED POWER SEMICONDUCTORS LTD.

COMPANY'S PROFILE

OCTOBER 1986

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SEMICONDUCTOR
INDUSTRY
SERVICE

1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 971-9000 Telex 171973

Integrated Power Semiconductors Ltd.

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Integrated Power Semiconductors Ltd.
Corporate Headquarters
MacIntosh House
Livingston, EH5 4 7BW
Scotland
Tel: 011 44 506 416416

1. Executive Summary

Integrated Power Semiconductor, Ltd. (IPS), designs, develops, and manufacturers monolithic standard, semicustom, and full custom high-current, high-power, ICs (smart power ICs). IPS products address high power monolithic smart power IC applications for power controllers and power drivers in the U.S. and European markets. The Company is dedicated to the solutions of monolithic power control and is prepared to address the issues of mixed technology, varying power levels, and nonstandard packaging.

2. General Information

U.S. Headquarters: Integrated Power Semiconductors Ltd.
2727 Walsh Avenue
Santa Clara, CA 95051
Tel:(408)727-2772

2.1 Company Background/History

IPS was founded by a group of Silicon Valley engineers to produce the "next generation" large-scale ICs for controlling switched-mode power supplies, motors, and actuators used in computer peripherals and industrial products. IPS's efforts are toward integrating bipolar, CMOS, and DMOS on a single chip, a new technology frequently termed "SMARTPOWER". Integrated Power's charter was conceived in 1983, and IPS was formed in April 1984 to fill the void left when most semiconductor manufacturers moved to digital ICs. The Company's first products were offered in early 1985.

2.2 Major Milestones

March 1985 - IPS offered several series of Voltage Regulators

March 1985 - IPS added a series of Positive Voltage Regulators

June 1985 - The IP50A Series and IP138 Series Voltage Regulators were introduced

Aug. 1985 - IPS introduced a series of Regulating Pulse Modulators.

Oct. 1985 - IPS added a series of Push-Pull Drivers in 16-pin or 20-pin batwing DIP packages.

Feb. 1986 - IPS opened its $18 million plant in Scotland. Shipments to begin second quarter 1986.

2.3 Management/Employees

IPS's Company Executives

Position	Name	Current Company	Current Position
Chairman	Jack Armstrong	Allen Bradley	Mng Director
Director	John Wesley	3i Ventures	Member
Director	Henderson	Newmarket Ventures	Chairman
Director	Peter English	Venture Capital Funding	Partner
		Prior Company	**Prior Position**
Mng Dir/CEO	David Wood	Silicon General	Dir Eng
Dir Operations	Robert Genesi	Silicon General	Pres Semi Div
R&D Mgr	Tony Lear	TI	R&D Mktg Dev Mgr
Dir US Sales/Mktg	Herb Scott	TI	Mgr OEM Sales
Dir Finance	Thomas Valentine	Beckman	Finance Dir
Applications Mgr	Norman Matzen	Astec Systems	Design Mgr
Engineering Mgr	Eric Joseph	Motorola	Prod Design Mgr

Great Britain has a greater density of semiconductor manufacturers and research groups than any other European country, it was easy for Integrated Power to augment the American staff with local technical expertise and management skills of the highest caliber. Many of the local experts come from subsidiaries of other American manufacturers also located in what is known as "Silicon Glen".

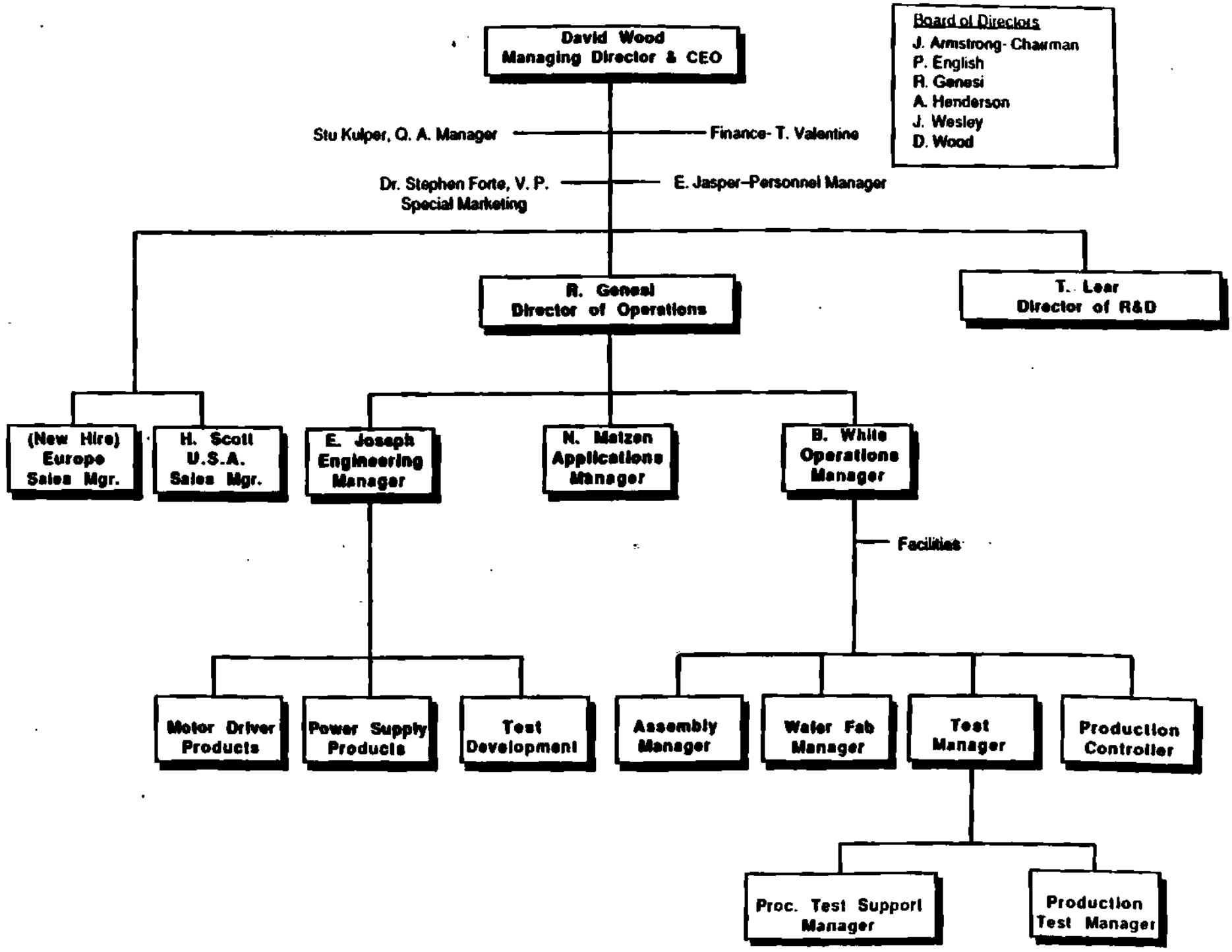
Currently IPS employs 120 employees in total.

2.4 Company Organizational Chart

(Please refer to page 3)

2.5 Acquisitions and Mergers

IPS is a venture capital firm established in 1984. There are no acquisitions or mergers to date.


David Wood
Managing Director & CEO
Board of Directors
J. Armstrong- Chairman
P. English
R. Genesi
A. Henderson
J. Wesley
D. Wood
Stu Kulper, Q. A. Manager
Finance- T. Valentine
Dr. Stephen Forte, V. P.
Special Marketing
E. Jasper–Personnel Manager
R. Genesi
Director of Operations
T. Lear
Director of R&D
(New Hire)
Europe
Sales Mgr.
H. Scott
U.S.A.
Sales Mgr.
E. Joseph
Engineering
Manager
N. Matzen
Applications
Manager
B. White
Operations
Manager
Facilities
Motor Driver
Products
Power Supply
Products
Test
Development
Assembly
Manager
Wafer Fab
Manager
Test
Manager
Production
Controller
Proc. Test Support
Manager
Production
Test Manager

3. Financial Information (for public companies)

3.1 Major Investors

Financing for IPS is as follows:

Date	Round	Sources	Amount
1984	Round 1	3i Ventures; ATA Venture Capital Fund Ltd.; Charterhouse Japhet; CIN Industrial Investments Ltd.; British Government	$8.0M
	Grants		$8.0M
	Bldg/Equip Lease		$13.0M
March 1986	Round 2	3i Ventures; Newmarket;Charterhouse Japhet; Scottish Development Agency; Robert Fleming & Associates; and others	$8.0M
1984	Equip Lease		$3.0M
	Bank Line of Credit		$2.0M
July 1986	Round 3	(Round 2 investors)	$6.0M

3.2 Balance Sheet/Income Statement

IPS is a private company. An actual balance sheet or income statement is not publicly available. Dataquest estimates IPS's total current assets and liabilities to be approximately $15 - $16 million dollars.

3.3 Financial Ratios

Not Available.

4. Operations

4.1 Lines of Business/Revenue

(Please refer to Section 6, Products and Technologies, page 8)

4.2 Semiconductor Revenue as Percentage of Total

Not Available.

4.3 Manufacturing Locations/Plans

Livingston, Scotland 45,000 sq. ft. design, fabrication, test

This facility is an ultramodern class 10/100. The manufacturing area includes complete testing, military assembly, quality assurance, burn-in, cage, and dock facilities.

Major reasons for IPS's decision to locate in Scotland are due to the $9 million of financial support the government of Great Britain provided for building the plant. Also, the government provided R & D grants and capital of $8 million.

4.4 Capital Spending/Research & Development

IPS has set both short term and long term research and development goals for itself. The firm has more proven power IC design engineers on its staff than any other semiconductor company. Therefore the markets IPS targets are predominately motor controls, motor drives, power supplies, solenoid drives, and relay drives, all of which require the control of currents of one-half ampere. IPS aims to provide cost-effective power IC products that will greatly increase equipment performance and reliability and reduce size requirements. The Company's R&D group is working on projects in four main areas as follows:

- MOS power structures (CMOS logic and "merged technology," CMOS and bipolar combinations) processes needed for certain applications, especially at 400 volts and more.

- Future Higher-voltage processes needs. 400 volts is a key level for off-line use at 115 volts AC; 1,000 volts is a level allowing off-line use at 220 volts AC.

- Semicustom IC design techniques, similar in concept to today's digital gate array and standard cell techniques, will be needed for rapid turnaround and lower volume.

- Cost-effective, high-power, high heat dissipating packages will be needed for power IC chips at high pin-count.

5. Market Analysis

5.1 Sales/Market Share by Product Category

Not Available

5.2 Market Share and Growth

Since IPS is a new player in the semiconductor industry it is not possible to estimate current market share. However, Dataquest does forecast $20M dollars in sales and the Company's first profitable year to be in 1988.

5.3 Major Competitors

Integrated Power's competitors appear to be a few small IC manufacturers with a limited commitment to this market. No other IC manufacturer competes with the Company across its full product range or market range. Large IC manufacturing companies are confining all their management efforts and resources to compete in the digital computer-chip markets, competing against Japanese manufacturers and against each other. Most have no expertise in power ICs.

Integrated Power's top five competitors are:

1) SGS
2) Motorola
3) General Electric
4) Unitrode
5) Siliconix

5.4 Business Strategy

IPS's goal is to be the leader in semicustom and full-custom, high-power monolithic smartpower ICs. To meet this objective, Integrated Power has accomplished the following:

. Assemble a top team of management and technical personnel who have proven success in the past (more proven power IC designers than any other company, for example).

. Chosen specific applications and designed the highest performance and highest quality ICs available. Integrated Power now has the broadest line of motor-drive ICs and power supply control ICs in the world.

. Implemented key account customer relationships with blue-chip equipment manufacturers for which power control and power-drive custom ICs are planned to be 60% of the company's business. These relationships help to define future, more sophisticated, products while at the same time cementing custom and semicustom sales opportunities.

. Installed local sales and service offices, complete with applications engineers, throughout the United States and Europe. These offices are augmented with a network of distributors' and manufacturers' representatives.

. Focused the R&D organization on developing technologies that will be needed three to four years in the future. This R&D organization is separate from the product design engineering group, but it supports that group.

. Created a large CAD design center to support customers' complex custom and semicustom IC needs.

5.5 Market & Product Positions

Market Position

The equipment market for Integrated Power's technology is presently growing at nearly 30% per year, but it is served by expensive circuit boards of older, discrete components and simpler logic ICs. Integrated Power projects the smartpower market will have the engineering and process technology available to meet the needs of this market and, as a result, many users will continue to use older, discrete components. This situation leaves near-term growth for smartpower ICs unlimited, but the reality of supply suggests that total power IC sales growth will average 25% per year.

Product Position

Integrated Power believes it is the technology leader in these power applications with a solid product base being manufactured in a new class 10/100 wafer fab and manufacturing facility. Established reliability with military vendors, major customers in the United States and Europe, and a large R&D organization provide firm support levels from which it can expand.

5.6 Channels of Distribution

To gain entrance quickly into a wide geographic area, Integrated Power has installed seven offices with experienced direct sales managers. To serve customers' needs, these sales offices are augmented by manufacturers' representatives in each territory. Distributors in each territory are also used to provide local sources of products and the company has a separate distribution manager.

US Sales Offices:

Santa Clara, CA (Northwest, Rocky Mountain)
Irvine, CA (Southwest)
North Andover, MA (Northeast)
Warwick, RI (Southeast and Special Accounts)

European Sales Offices:

Munich, West Germany (Central Europe)
Livingston, Scotland (Great Britain, Scandinavia)
Paris, France (Southern Europe)

5.7 Major Applications

Examples of applications for Integrated Power's high-ampere and high-voltage products are:

- Automobiles and Aircraft
- Factory Automation Equipment and Robotics
- Winchester Disk Drives and Office Printers
- Environmental and Process Controls
- Military Equipment

5.8 Sales Strategy

Because Integrated Power is responsive to market and customer needs and directions, its sales strategy is to concentrate on key accounts. Eventually, more than 60% of its business will be from key customers for custom and semicustom products.

Integrated Power does not intend to be a standard parts supplier for multi-sourced products. Its customers are in the military, industrial, and professional equipment markets, and its management group, sales staff, and engineering organization are all experienced in key account strategies with proven performance in this higher-than average margin segment of the semiconductor market.

Its ability to provide custom products is essential to the company's strategy. Its development of application-specific or semicustom technology, now so profitable for the digital IC world, will be a first in the power IC field.

Integrated Power's application engineering staff, coupled with its design engineers, its sales force, and its key account management, makes a formidable team for any given customer's project. A four-man team with one person from each group for each key account overwhelms the competition, which usually relies on a single sales person.

6. Products and Technologies

6.1 Key Products

High-power monolithic IC applications, which Integrated Power considers its primary market, are defined as handling up to 10 amperes with voltages up to 400 volts. There has been no adequate source of power ICs for this market. In the past, these applications have been served by circuit boards of discrete components or by hybrid packaging techniques, but these approaches have the inherent problems of being more expensive, more space consuming, and less reliable than IPS's monolithic solution.

All products are in high-dissipating, low-cost, power packages; their ranges include surface-mount and high pin-count power packages. Examples of IPS's specific company products are as follows:

- 4-amp stepper motor "H" bridge drives with logic
- 2.5-amp, three-phase, DC brushless motor drives with servo logic
- Switchmode, power supply control ICs
- 4-amp, dual-solenoid actuators
- 5-phase stepper motor drives (five "H" bridges on one chip)
- 6-amp, voltage-regulating ICs

6.2 Second Source and License Agreement

No second source or license agreements to date.

6.3 Product/Technology Highlight

Integrated Power has the broadest range of power control ICs, motor-drive ICs, and low-cost power IC packages available. Integrated Power also attempt to be the most responsive supplier to customers' specific power IC needs through its large CAD design center.

7. Non-Semiconductor Products Summary

All of Integrated Power's products are with in the semiconductor industry.

8. Dataquest Analysis

8.1 Long-term Outlook

Integrated Power's future looks favorable if a partner can be found. The Company needs a strategic alliance to help prevent IPS from becoming lost in a competitive battle with other discrete manufacturers like International Rectifier and Motorola. Although these two firms are not aiming for the same market niche as IPS, they do have the capability to move quickly into the custom and fully-custom market segment.

8.2 Challenges to Overcome

IPS's greatest challenge is how quickly the market will accept a new technology which replaces older methods of higher cost while surviving as a niche market firm until a strategic alliance can be formed.

IPS believes that corporate alliances are critical to help further define product applications of monolithic, smartpower ICs and to establish Integrated Power as the preferred choice for power controls and power drivers. Such alliances will provide the corporate partner with high-performance, low-cost, proprietary alternatives to its power-control needs. In turn, it will establish IPS's reputation in semicustom and custom monolithic smartpower ICs.

8.3 Opportunities

Integrated Power has good global orientation with easy access into the European and North American market. IPS has yet to make any kind of presence in the Far East.

IPS's early practical experience in power IC manufacturing and sales gives the firm a good headstart. Also, the firm's expertise in packaging allows certain advantages in developing higher voltage or higher power ICs.

8.4 Strengths and Weaknesses (excluding technology)

Strengths:

.Some of Integrated Power's strengths are in its fine team of design engineers in both digital and analog components.

.Since the firm is new and small it can meet customized production needs.

.The firm has already proven its expertise in power IC packaging and manufacturing capability allowing IPS to proceed with current sales of power ICs.

Weaknesses:

.IPS has formed itself around a narrow base and needs to avoid areas of strong competition in the future as others catch on to "SMARTPOWER". Despite the financial base IPS has succeeded in obtaining so far it will have to sustain itself for sometime while the market realizes the advantages of a never technology.

.Given the current situation of the semiconductor industry as a whole IPS's sales objectives maybe too optimistic although SMARTPOWER is a high growth market.

Dataquest
a company of
The Dun & Bradstreet Corporation

1290 Ridder Park Drive, San Jose, CA 95131-2398
(408) 971-9000 Telex 171973 Fax (408) 971-9003

International Rectifier

Company Profile

Dataquest
November 1986

Semiconductor
Industry Service

International Rectifier

Table of Contents:

International Rectifier Corporation
9220 Sunset Blvd.
Los Angeles, CA 90069

Tel: (213) 205-3100 Telex: 472-0403
FAX: 213-772-9028

1. Executive Summary

International Rectifier Corporation develops, manufacturers and sells a broad range of power semiconductor products used to control electricity in a variety of industrial, consumer and military applications. IR adapted MOS process technology to introduce in 1979 an innovative power MOSFET, marketed under the tradename HEXFET. Sales of this product have made IR the leading supplier in the power MOSFET market. In addition the firm has developed a line of power interface circuits, thyristors, rectifiers, Schottky diodes and conventional solid state relays.

2. General Information

2.1 Company Background/History

International Rectifier (IR), was founded as a California corporation in 1947 and re-incorporated as a Delaware corporation in 1979.

2.2 Management/Employees

IR currently employs over 2,300 employees worldwide. Approximately, 1,500 are employed in North America. There are no collective bargaining agreements between the Company and its employees in the US and there have been no work stoppages due to labor difficulties. Relationships between employees and management is considered to be good.

2.3 Company Organization

Directors:(Age)

Eric Lidow(73)	Chairman of the Board
Warren B. Hayes(62)	President, Hawkeye Associates, Inc.
Dr. George Krsek(65)	President, Houba, Inc.
Alan E. Lidow(44)	President, The Charles Group
Dr. Rochus E. Vogt(56)	Vice President and Provost, California Institute of Technology

Officers:

Eric Lidov(73)	President
George H. Krause(57)	Ex. Vice President-Finance and Treasurer
Robert J. Mueller(57)	Ex. Vice President-World Marketing and Foreign Operations
Richard D. Farrer(58)	Vice President-Corporate Planning and Shareholder Relations
Gerald A. Koris(58)	Vice President-Secretary and General Counsel
Kay Dickinson(n/a)	Assistant Secretary

Eric Lidov-Founder of IR and has been officer & director since the Company's inception in 1947.

Warrem B. Hayes-Director since 1970. Hawkeye Associates,Inc. is an investment broker.

Dr. George Krsek-Director since 1979. Houba, Inc. is a pharmaceutical consulting firm.

Alan Lidov-Joined IR in 1974. Was Director and Vice President since 1984 and formerly general manager of IR's Crydom Solid State Products Division. Alan is the oldest son of Eric Lidov.

Dr. Rochus E. Vogt-Director since 1984.

George H. Krause-Joined IR in 1968 as Corporate Controller and Assistant Treasurer, promoted to Treasurer in May 1971, to Corporate Vice President in April 1974, to Vice President-Finance in March 1977 and to Executive Vice President-Finance an August 1984.

Robert J. Mueller-Started as Vice President of Marketing for the Semiconductor Division, in 1968 he became Vice President-Foreign Operations, followed by his current position since 1977.

Richard D. Farrer-Has held his current position since 1984.

Gerald A. Koris-Previously held the position of Assistant Secretary and patent counsel. Current position has been held since 1969.

2.4 Company Organization

IR has two affiliated companies overseas.

- International Rectifier Corporation (Japan) Limited, Tokyo, Japan; 16% owned
- Ruttonsha-International Rectifier Private Ltd, Bombay, India 34% owned.

3. Financial Information (for public companies)

3.1 Major Investors

International Rectifier's common stock is listed on the New York and Pacific Stock Exchanges. As of Oct. 1985, there were 2,701 shareholders with Eric Lidow owning 20.7% and other officers and directors as a group owning 23.9%.

3.2 Balance Sheet/Income Statement

(Please refer to pages 4,5,6,7,8)

3.3 Financial Ratios

(Please refer to page 9)

4. Operations

4.1 Lines of Business/Revenue

(Please refer to Table 2 on page 5.)

4.2 Semiconductor Revenue as Percentage of Total

(Please refer to Tables 1 and 2 on page 4 and 5.)

4.3 Manufacturing Locations/Plans

International Rectifier leases five facilities in El Segundo with a total square footage of 72,000 ft. These are the principal production facilities for its semiconductor products. IR's MOSFET 4-inch silicon wafer production plant has been construction in Rancho, California.

IR has been in the process of down-sizing its operations by selling major assets of its pharmaceutical subsidiary, Rachelle Laboratories. Also, the company has sold 25% of its European distributor subsidiary, B.V. Diode.

4.4 Capital Spending/Research and Development

Currently IR is involved in ongoing research and development directed toward new device development, quality improvement, and development expenditures. The Company may engage in customer funded research in the future.

Research & Development Expenditure 1983-1985
(Millions of US Dollars)

1983	1984	1985
$ 4.3	$ 5.8	$ 7.4

International Rectifier Corporation

International Rectifier Corporation*
9220 Sunset Boulevard
Los Angeles, California 90069
Telephone: (213) 205-3100
(Millions of Dollars Except Per Share Data)

Balance Sheet (June 30)

	1981	1982	1983	1984	1985
Working Capital	$ 48.0	$ 38.5	$ 34.4	$ 35.9	$ 76.4
Long-Term Debt	$ 37.6	$ 34.6	$ 34.3	$ 14.9	$ 73.4
Shareholders' Equity	$ 45.8	$ 39.9	$ 24.5	$ 53.4	$ 53.1
After-Tax Return on Average Equity (%)	7.7	(5.4)	(48.1)	20.8	12.9

Operating Performance (Fiscal Year Ending June 30)

	1981	1982	1983	1984	1985
Revenue	$ 126.2	$ 119.2	$ 126.8	$ 116.7	$ 135.6
U.S. Revenue	$ 78.5	$ 78.2	$ 85.6	$ 69.4	$ 78.7
Non-U.S. Revenue	$ 47.7	$ 41.0	$ 41.2	$ 47.3	$ 56.9
Cost of Revenue	$ 86.2	$ 84.4	$ 89.2	$ 75.1	$ 91.5
R&D Expense	$ 3.5	$ 4.9	$ 5.4	$ 5.8	$ 7.4
SG&A Expense	$ 28.1	$ 28.2	$ 30.3	$ 26.0	$ 29.8
Pretax Income	$ 3.8	$ (5.3)	$ (15.7)	$ 7.3	$ 8.2
Pretax Margin (%)	3.0	(4.5)	(12.4)	6.3	6.0
Effective Tax Rate (%)	15.7	N/A	N/A	28.6	15.9
Net Income	$ 3.2	$ (2.3)	$ (15.5)	$ 8.1	$ 0.2
Average Shares Outstanding** (Millions)	8.43	8.34	8.39	9.09	10.73
Per Share					
Earnings	$ 0.41	$ (0.28)	$ (1.85)	$ 0.89	$ 0.02
Dividend	$ 0.11	$ 0.11	$ -	$ -	$ -
Book Value	$ 5.50	$ 4.77	$ 2.87	$ 4.99	$ 4.94
Price Range	$1 1/10-9	$2 1/10-6 2/3	$ 2 1/2-12 2/3	$ 9 1/8-16 1/8	$ 9 1/2-17 1/2
Total Employees	1,944	1,850	1,973	2,146	2,200
Capital Expenditures	$ 14.30	$ 7.23	$ 4.14	$ 8.14	$ 25.87

N/A = Not Applicable
*1984 and 1985 have been adjusted to exclude Rachelle Labs which was sold in October 1984. The 1984 After-Tax Return on Average Equity, however, includes Rachelle Labs.
**In November 1984, IR had a three-for-two stock split. All share data has been adjusted, accordingly.

Source: International Rectifier Corporation, Annual Reports and Forms 10-K
DATAQUEST
May 1986

International Rectifier Corporation

Table 1

International Rectifier Corporation
ESTIMATED REVENUES BY LINE OF BUSINESS
(Millions of Dollars)

	Fiscal Year Ending June 30				
	1981	1982	1983	1984	1985
Semiconductors	$ 89.7	$ 86.6	$ 88.6	$116.7	$135.6
Antibiotics Rachelle Labs (Discontinued Operations--1985)	36.5	32.6	38.2	6.1	0.0
Total	$126.2	$119.2	$126.8	$122.8	$135.6

Table 2

International Rectifier Corporation
ESTIMATED SEMICONDUCTOR REVENUES
(Millions of Dollars)

	Calendar Year				
	1981	1982	1983	1984	1985
Power Transistors	$14	$17	$20	$ 34	$ 43
Power Diodes	46	42	40	56	60
Zener Diodes	1	1	1	2	2
Thyristors	23	20	20	23	23
Total Discretes	$84	$80	$81	$115	$128
Optoelectronics	2	2	3	0	0
Total Semiconductor	$86	$82	$84	$115	$128

Source: International Rectifier Corporation
Annual Reports
DATAQUEST
May 1986

Table 3

International Rectifier Corporation
FINANCIAL STATEMENT HISTORY 1978-1985*
(Millions of Dollars)

		Fiscal Year Ending June 30									
		1978	1979	1980	1981	1982	1983	1984	1985	CAGR	LSQR
BALANCE SHEET											
1	CASH & LIQUID SECURITIES	11.06	4.94	4.46	2.92	2.53	2.48	2.26	35.45	18.19	2.69
3	RECEIVABLES	19.96	23.66	31.04	28.29	22.49	24.60	29.37	38.13	6.86	3.69
4	INVENTORY	25.82	34.37	42.95	42.47	44.27	35.68	26.98	48.21	8.53	1.63
5	DEFERRED TAX/INC TAX REFN	3.02	3.66	5.23	8.42	6.61	5.59	1.18	0.98	(15.94)	(15.61)
6	PREPAID EXPENSES	1.68	1.39	1.42	1.11	0.92	0.63	0.66	0.84	(3.41)	(9.15)
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	TOTAL CURRENT ASSETS	60.94	67.42	85.11	83.22	76.82	68.98	60.29	107.53	8.45	3.27
9	GROSS P P E	32.18	35.67	49.72	56.66	58.65	38.54	45.58	68.61	11.78	7.41
10	ACCUMULATED DEPRECIATION	15.92	15.00	16.99	16.00	18.99	13.27	15.72	19.83	2.58	1.63
11	NET P P E	16.27	20.66	32.73	39.18	39.66	26.27	29.86	50.78	17.66	11.52
12	MISC ASSETS	1.21	1.00	0.94	0.84	1.92	0.34	5.66	2.83	12.87	28.26
13	ACCTS RECBLS > ONE YR	0.00	0.00	2.51	2.77	1.38	1.07	0.86	0.00	0.00	0.00
15	*TOTAL ASSETS*	78.42	89.08	121.30	126.00	119.38	102.66	96.67	161.14	10.84	6.00
16	NOTES PAYABLE	3.66	0.66	10.28	6.00	0.41	3.14	5.00	5.00	7.84	9.09
17	ACCOUNTS PAYABLE	7.48	11.77	12.31	9.29	9.92	9.81	10.27	11.97	6.94	2.48
18	ACCRUED TAXES	5.63	3.44	0.84	0.21	0.66	0.28	0.44	0.00	0.00	0.00
19	ACCRUED LIABILITIES	12.66	12.65	19.76	15.66	15.10	10.28	8.15	10.33	(2.17)	(4.58)
20	CURR MAT LONG TERM DEBT	1.00	1.91	1.40	2.58	4.28	5.66	1.71	2.93	6.58	6.58
22	TOTAL CURRENT LIABILITIES	30.70	30.82	44.51	38.10	30.34	34.53	24.38	31.12	0.28	(2.07)
23	LONG TERM DEBT	16.61	20.94	29.10	37.58	34.98	34.28	14.00	73.41	23.66	11.44
24	DEFERRED CREDITS	0.90	1.53	3.31	0.24	5.32	5.00	1.30	1.84	2.66	1.54
25	MISC LIABILITIES	0.00	0.00	1.06	1.15	1.12	4.33	2.72	2.46	0.00	0.00
27	DEFICIT FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	TOTAL LIABILITIES	48.21	53.30	77.00	80.17	78.36	78.10	43.27	109.83	12.22	5.63
29	PREFERRED STOCK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	COMMON STOCK	2.81	2.83	2.96	2.98	2.99	6.00	7.14	10.75	21.11	21.24
31	CAPITAL SURPLUS	7.72	7.80	10.53	10.72	10.76	9.10	29.17	26.10	19.01	19.12
32	RETAINED EARNINGS	19.67	25.16	29.83	32.14	28.83	13.45	21.57	21.78	1.46	(3.00)
33	CUM TRANSL ADJ	0.00	0.00	0.00	0.00	(2.75)	(4.17)	(4.47)	(5.53)	0.00	0.00
34	TOTAL EQUITY	30.21	35.79	43.32	45.84	39.94	24.48	53.40	53.11	8.40	5.00
35	*TOTAL LIAB & EQUITY*	78.42	89.08	121.30	126.00	118.30	102.66	96.67	161.14	10.84	6.00
36	NET WORKING CAPITAL	30.24	36.60	40.60	40.82	38.48	34.45	35.91	76.41	14.16	6.99
INCOME & EXPENSES											
38	SALES	89.00	110.49	136.62	126.23	119.18	120.81	116.71	135.58	6.18	3.55
40	COST OF GOODS	68.42	72.48	86.43	80.16	77.61	81.83	80.89	85.45	5.97	2.51
41	GROSS PROFITS	20.66	38.00	51.19	46.07	41.57	44.98	46.82	50.13	8.32	5.46
42	S G & A EXPENSE	17.11	20.52	26.06	28.09	28.24	30.30	26.80	29.63	8.27	6.68
43	R&D EXPENSE	1.98	2.95	3.45	3.90	4.92	5.44	5.76	7.43	24.75	21.87
45	OPERATING PROFIT	9.97	14.93	20.78	14.48	8.42	9.24	15.06	12.87	3.71	(1.35)
46	DEPRECIATION	2.21	2.16	2.90	3.94	4.81	5.12	3.61	4.39	10.28	11.69
47	LEASE PAYMENTS	1.40	1.48	1.96	2.08	2.03	2.21	1.64	1.89	2.76	2.64
48	INTEREST EXPENSE	1.49	1.89	3.08	4.98	7.58	6.39	2.81	3.31	12.06	11.95
49	MISC EXPENSE	0.26	(0.33)	(0.51)	(0.28)	(0.56)	(0.23)	(0.34)	(4.78)	0.00	0.00
51	DIVIDENT EXPS	0.76	0.55	0.58	0.21	0.00	0.00	0.02	(7.45)	0.00	0.00
53	PRETAX PROFIT	5.36	10.29	13.05	4.83	(5.37)	(4.24)	8.15	8.73	(24.63)	0.00
54	INCOME TAXES	1.82	4.15	4.23	0.68	(3.05)	(0.19)	2.83	1.30	(4.65)	0.00
55	EXTRAORD LOSS (GAIN)	0.19	0.00	3.31	0.00	0.00	11.44	(2.81)	(0.79)	0.00	0.00
56	NET PROFIT	3.35	6.14	5.51	3.43	(2.32)	(15.49)	8.12	8.21	(32.73)	0.00
57	EPS AFTER PFD DIVIDENDS	0.61	0.77	0.67	0.41	(0.28)	(1.85)	0.89	0.82	(35.36)	0.00
58	COMMON DIV PER SHARE	0.20	0.25	0.32	0.32	0.32	0.00	0.00	0.00	0.00	0.00

*In fiscal 1985, International Rectifier sold its Rochelle Labs facility. This data includes restatement of 1984 to exclude Rochelle Labs. Data through 1983 includes this facility. The effect of the restatement on sales was to decrease 1984 from $122.8 to the present $116.7.

In fiscal 1981, IR's Kelsey Division was sold. During that year, data was revised to reflect continuing operations. Data prior to that year contains a combination of restated and originally reported data. Because of restatements years cannot always be compared.

Source: International Rectifier Corporation Annual Reports
DATAQUEST
May 1986

Table 4

International Rectifier Corporation
FINANCIAL STATEMENT HISTORY 1978-1985
(Percent)

Fiscal Year Ending June 30

		1978	1979	1980	1981	1982	1983	1984	1985	CAGR	LSQR
BALANCE SHEET											
1	CASH & LIQUID SECURITIES	14.11	9.55	3.68	2.32	2.12	2.33	2.34	22.88	6.55	(3.12)
3	RECEIVABLES	29.45	26.56	25.59	22.45	18.85	24.04	30.38	18.70	(4.31)	(2.18)
4	INVENTORY	32.93	38.58	35.41	33.71	37.11	34.75	27.83	24.95	(3.89)	(4.12)
5	DEFERRED TAX/INC TAX REFN	3.85	3.43	4.32	6.88	9.54	9.45	1.14	0.56	(24.16)	(19.82)
6	PREPAID EXPENSES	1.37	1.56	1.17	0.88	0.77	0.61	0.68	0.52	(12.86)	(14.29)
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	TOTAL CURRENT ASSETS	77.71	75.68	70.16	66.04	64.40	67.19	62.37	66.73	(2.15)	(2.57)
9	GROSS P P E	41.04	40.04	40.99	44.49	49.16	38.52	47.15	43.32	0.78	1.33
10	ACCUMULATED DEPRECIATION	20.30	16.84	14.68	13.40	15.92	12.93	16.28	11.81	(7.45)	(4.69)
11	NET P P E	20.74	23.20	26.99	31.09	33.24	25.58	30.88	31.52	6.16	5.21
12	MISC ASSETS	1.55	1.12	0.78	0.87	1.27	6.18	5.88	1.78	1.84	21.88
13	ACCTS RECBLS > ONE YR	0.00	0.00	2.07	2.20	1.88	1.04	0.00	0.00	0.00	0.00
15	*TOTAL ASSETS*	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	(0.00)
16	NOTES PAYABLE	4.08	0.98	8.41	6.42	7.88	3.85	3.93	3.85	(3.42)	2.92
17	ACCOUNTS PAYABLE	9.54	13.21	10.15	7.37	8.31	9.58	10.02	7.43	(3.51)	(3.39)
18	ACCRUED TAXES	7.18	3.88	0.00	0.17	0.56	0.27	0.46	0.00	0.00	0.00
19	ACCRUED LIABILITIES	15.37	14.43	10.29	11.95	12.66	15.84	8.43	6.41	(11.74)	(9.88)
20	CURR MAT LONG TERM DEBT	2.40	2.14	1.10	2.82	3.57	4.91	1.77	1.82	(3.88)	2.43
22	TOTAL CURRENT LIABILITIES	38.15	34.88	30.88	27.93	32.14	33.64	25.22	19.31	(9.88)	(7.61)
23	LONG TERM DEBT	21.18	23.51	23.88	29.83	28.88	33.37	19.38	45.56	11.58	5.13
24	DEFERRED CREDITS	1.15	1.72	2.73	4.88	4.48	4.93	1.34	0.85	(7.83)	(4.21)
25	MISC LIABILITIES	0.00	0.00	0.00	0.91	0.84	4.22	2.81	1.53	0.00	0.00
27	DEFICIT FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	TOTAL LIABILITIES	61.48	58.83	64.29	63.62	66.52	76.16	44.78	67.84	1.25	(0.35)
29	PREFERRED STOCK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	COMMON STOCK	3.59	3.10	2.44	2.37	2.51	5.94	7.38	6.67	9.27	14.38
31	CAPITAL SURPLUS	9.84	8.75	8.88	8.58	9.82	8.87	38.18	16.29	7.38	12.36
32	RETAINED EARNINGS	25.89	28.25	24.58	25.91	24.25	13.10	22.31	13.52	(8.46)	(8.49)
33	CUM TRANSL ADJ	0.00	0.00	0.00	0.00	(2.31)	(4.88)	(4.63)	(3.43)	0.00	0.00
34	TOTAL EQUITY	38.52	40.17	35.71	36.38	33.48	23.84	55.24	32.96	(2.29)	(8.94)
35	*TOTAL LIAB & EQUITY*	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	(0.00)
36	NET WORKING CAPITAL	38.57	41.00	33.47	38.11	32.25	33.55	37.15	47.42	3.88	8.94
INCOME & EXPENSES											
38	SALES	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	(0.00)
40	COST OF GOODS	67.83	65.00	62.53	63.58	65.12	64.53	59.88	63.83	(1.04)	(1.01)
41	GROSS PROFITS	32.17	34.48	37.47	36.58	34.88	35.47	40.12	36.97	2.81	1.84
42	S G & A EXPENSE	18.28	18.58	19.73	22.25	23.88	23.88	22.28	22.88	1.96	3.82
43	R&D EXPENSE	1.77	2.31	2.52	2.78	4.12	4.29	4.84	5.48	17.48	17.68
45	OPERATING PROFIT	11.18	13.51	15.21	11.47	7.87	7.28	12.98	8.49	(2.33)	(4.74)
46	DEPRECIATION	2.48	1.98	2.12	3.12	4.84	4.84	3.18	3.24	3.85	7.86
47	LEASE PAYMENTS	1.57	1.34	1.44	1.65	1.78	1.74	1.48	1.25	(3.22)	(0.88)
48	INTEREST EXPENSE	1.87	1.71	2.85	3.88	6.38	5.84	2.41	2.44	9.53	8.11
49	MISC EXPENSE	0.38	(0.38)	(0.37)	(0.22)	(0.44)	(0.18)	(0.29)	(3.46)	0.00	0.00
51	DISCONT OPNS	0.88	0.58	0.37	0.18	0.88	0.88	0.78	(5.49)	0.00	0.00
53	PRETAX PROFIT	6.82	9.31	9.95	3.19	(4.51)	(3.35)	6.98	0.54	(29.28)	0.00
54	INCOME TAXES	2.84	3.75	3.10	0.48	(2.56)	(0.15)	2.43	0.86	(18.21)	0.00
55	EXTRAORD LOSS (GAIN)	0.21	0.88	2.42	0.88	0.88	9.82	(2.41)	(0.58)	0.00	0.00
56	NET PROFIT	3.78	5.56	4.83	2.72	(.1.94)	(12.21)	6.96	0.15	(36.64)	0.00
57	EPS AFTER PFD DIVIDENDS	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	(0.00)
58	COMMON DIV PER SHARE	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	(0.00)

*In fiscal 1985, International Rectifier sold its Rochelle Labs facility. This data includes restatement of 1984 to exclude Rochelle Labs. Data through 1983 includes this facility. The effect of the restatement on sales was to decrease 1984 from $122.8 to the present $116.7.

In fiscal 1981, IR's Relay Division was sold. During that year, data was revised to reflect continuing operations. Data prior to that year contains a combination of restated and originally reported data. Because of restatements years cannot always be compared.

Source: International Rectifier Corporation
Annual Reports
DATAQUEST
May 1986

SIS Companies

Table 5

International Rectifier Corporation
FUNDS FLOW HISTORY 1978-1985
(Millions of Dollars)

		Fiscal Year Ending June 30									
		1978	1979	1980	1981	1982	1983	1984	1985	CAGR	LSQR
SOURCES											
56	NET PROFIT	3.35	6.14	5.51	3.43	(2.32)	(15.49)	8.12	0.21	(32 73)	0 00
46	DEPRECIATION	2.21	2.16	2.90	3.94	4.81	5.12	3.61	4.39	10.28	11 69
61	NEW LONG TERM DEBT	2.90	6.24	9.56	11.63	1.26	4.72	0 00	61 47	54 12	0 00
62	NEW EQUITY	1.05	1.42	4 64	1.75	(0.93)	0.63	20.80	(0 50)	0 00	0 00
63	INCR OTHER LIABILITIES	(0.83)	0.63	2.85	3.01	(0.95)	2.90	(5.30)	(0.51)	49 32	0 00
66	TOTAL SOURCES	9.56	16.59	25.45	23.16	1.87	(2.00)	27.16	65.06	31 52	0.00
USES											
67	P P E EXPENDITURES	5.43	6.55	14.96	10.39	5.30	(8.27)	7.20	25.32	24.61	0 00
68	REPAYMENT LONG TERM DEBT	1.45	1.00	1.91	1.49	2.56	4 26	22.72	1.71	2.37	21 87
69	PREFERRED DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0 00
70	COMMON DIVIDENDS	1.62	1.99	2.82	2.00	2.00	0.00	0.00	0.00	0.00	0 00
71	INCR OTHER ASSETS	(0.20)	(0.21)	2.46	0.15	(0.79)	4.00	(0.00)	(3.60)	44.53	0.00
72	INCR WORKING CAPITAL	1.34	6.30	3.90	8.57	(7.83)	(3.25)	(1.87)	41.72	63.46	0.00
74	TOTAL USES	9.56	16.59	25.45	23.16	1.87	(2.00)	27.16	65.06	31.52	0.00
75	EXCESS/DEFICIT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
76	CUMULATIVE SUR/DEF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

•In fiscal 1985, International Rectifier sold its Rochelle Labs facility. This data includes restatement of 1984 to exclude Rochelle Labs. Data through 1983 includes this facility. The effect of the restatement on sales was to decrease 1984 from $122.8 to the present $116.7.

In fiscal 1981, IR's Raley Division was sold. During that year, data was revised to reflect continuing operations. Data prior to that year contains a combination of restated and originally reported data. Because of restatements years cannot always be compared.

Source: International Rectifier Corporation
Annual Reports
DATAQUEST
May 1986

Table 6

International Rectifier Corporation
FINANCIAL RATIO HISTORY 1978-1985

	Fiscal Year Ending June 30									
	1978	1979	1980	1981	1982	1983	1984	1985	ST AVG	WT AVG
LIQUIDITY										
1 CURRENT RATIO	1.985	2.187	1.912	2.368	2.884	1.998	2.473	3.456	2 297	2 459
2 QUICK RATIO	1.011	0.928	0.798	0 887	0.853	0.784	1.297	2.187	1 058	1 187
3 CASH RATIO	0.368	0.188	0.188	0 883	0.886	0.868	0 893	1.138	0 259	0 328
4 WORKING CAPITAL/SALES	0.338	0.331	0.297	0 388	0.323	0.272	0 388	0.564	0 352	0 378
6 DAYS RECEIVABLES	81.773	78.188	82.937	81 888	88.889	71.837	91 849	81.114	79 896	79 987
7 DAYS INVENTORY	156.984	173.893	183.498	193.385	288.217	158.138	148.587	171.753	173 198	171 658
LEVERAGE										
8 LONG TERM DEBT/CAPITALIZ	0.388	0.388	0.482	0.451	0.484	0.583	0.218	0.588	0 428	0 447
11 LONG TERM DEBT/EQUITY	0.588	0.585	0.872	0.828	0.886	1.488	0.279	1.382	0.818	0 918
12 TOTAL DEBT/EQUITY	0.753	0.882	0.948	1.852	1.183	1.734	0.382	1.548	1.829	1 124
COVERAGE										
13 EBIT/INTEREST	4.987	6.449	4 388	1.823	0.284	0.338	3.889	1.228	2.871	2 176
14 FIXED CHARGE COVERAGE	2.884	4.888	3.232	1 577	0 438	0.587	2.832	1.145	2.888	1 788
18 REPAY LTD+FIX CHARGE COV	1.988	2.883	2.437	1 314	0.344	0.338	0.484	0.884	1.282	0.931
OPER PERFORMANCE										
17 GROSS PROFIT/SALES	0.322	0 344	0.375	0.385	0 349	0.388	0.481	0.378	0.388	0.388
18 OPER PROFIT/SALES	0.112	0 138	0 152	0.118	0.871	0.873	0.128	0.885	0.118	0.184
21 PRETAX PROFIT/SALES	0.888	0 883	0.886	0 832	(0.848)	(0.833)	0.878	0.888	0.838	0.821
22 NET PROFIT/SALES	0.838	0.858	0.848	0 827	(0.819)	(0.122)	0.878	0.882	0.811	0.881
23 NET PROFIT/AVG EQUITY	0.118	0 188	0.138	0.877	(0.884)	(0.481)	0.288	0.884	0.825	(0.812)
24 NET PROFIT/AVG CAPITALIZ	0.875	0 119	0 885	0.844	(0.829)	(0.232)	0.128	0.882	0.824	0.885
26 NET PROFIT/AVG TOT ASSETS	0.845	0 873	0.882	0.828	(0.819)	(0.148)	0.882	0.882	0.815	0.883
27 E P S GROWTH RATE	1.353	0 872	(0.128)	(0.388)	(1.677)	5.582	(1.484)	(0.878)	0.388	0.225
28 SALES GROWTH RATE	0.188	0 248	0.237	(0.878)	(0.886)	0.884	(0.888)	0.182	0.883	0 853
TURNOVER										
31 SALES/AVG EQUITY	3.881	3.348	3.454	2.832	2.779	3.937	2.987	2.546	3 123	3 885
32 SALES/AVG CAPITALIZ	1.985	2.134	2.118	1 628	1.588	1.983	1.838	1.382	1 812	1 723
33 SALES/AVG TOT DEBT + EQTY	1.771	1 978	1 984	1 418	1 315	1 648	1 858	1 287	1 623	1 543
34 SALES/AVG TOTAL ASSETS	1 285	1 319	1 299	1 821	0 972	1.143	1 171	1 852	1.148	1 115
35 SALES/AVG OPER ASSETS	1 227	1 337	1 327	1 851	0 998	1 198	1.258	1 891	1 188	1 161
38 SALES/AVG GROSS P P E	3 198	3 257	3 288	2 387	2.878	2 583	2.742	2 358	2 718	2 575
BALANCE SHEET										
37 CASH/SALES	0 124	0 845	0 833	0 823	0 821	0 819	0 819	0 261	0 868	0 879
38 RECEIVABLES/SALES	0 224	0 214	0 227	0 224	0 189	0 195	0 252	0 222	0 218	0 219
41 INVENTORY/SALES	0 298	0 311	0 314	0 338	0 371	0 281	0 231	0 297	0 384	0 298
42 OTH CURR ASSETS/SALES	0 834	0 828	0 838	0 887	0 855	0 844	0 889	0 887	0 835	0 831
44 GROSS P P E/SALES	0.361	0 323	0 384	0 444	0 492	0 312	0 391	0 515	0 488	0 418
45 LINE 13/SALES	0 888	0 888	0 818	0 822	0 811	0 888	0 887	0 888	0 888	0 888
46 MISC ASSETS/SALES	0 814	0 889	0 887	0 887	0 813	0 858	0 848	0 821	0 821	0 826
47 ACCOUNTS PAYABLE/SALES	0 884	0 187	0 888	0 874	0 883	0 877	0 888	0 888	0 886	0 885
48 ACCRUED TAXES/SALES	0 883	0 831	0 886	0 882	0 886	0 882	0 884	0 888	0 814	0 888
51 ACCRUED LIABILITY/SALES	0 138	0 116	0 145	0 119	0 127	0 128	0 878	0 876	0 115	0 185
53 DEFERRED TAXES/SALES	0 818	0 814	0 824	0 849	0 845	0 848	0 811	0 888	0 825	0 825
54 MISC LIABILITIES/SALES	0 888	0 888	0 888	0 889	0 889	0 834	0 823	0 818	0 813	0 817
56 LINE 20/SALES	0 888	0 888	0 888	0 888	0 888	0 888	0 888	0 888	0 888	0 888
MISCELLANEOUS										
57 EQUITY PER COMMON SHARE	3 724	4 587	5 294	5 529	4 828	2 917	5 874	4 951	4 782	4 887
58 RETIRE/PREV GROSS P P E	0 888	(0 885)	(0 826)	(0 881)	(0 848)	(0 185)	(0 829)	(0 824)	(0 848)	(0 882)
61 DEPREC/PREV GROSS P P E	0 881	0 887	0 881	0 879	0 888	0 887	0 891	0 896	0 885	0 887
62 COM DIVS/EBIN-PFD DIVS	0 484	0 323	0 475	0 774	(1 143)	0 888	0 888	0 888	0 114	(0 882)
63 TAX RATE	0 338	0 483	0 324	0 149	0 589	0 848	0 348	1 792	0 498	0 628
64 COST OF GOODS/SALES	0 678	0 656	0 625	0 635	0 651	0 645	0 589	0 638	0 648	0 632

•In fiscal 1985, International Rectifier sold its Rochelle Labs facility This data includes restatement of 1984 to exclude Rochelle Labs Data through 1983 includes this facility The effect of the restatement on sales was to decrease 1984 from $122 8 to the present $116 7

In fiscal 1981 IR's Raley Division was sold During that year data was revised to reflect continuing operations Data prior to that year contains a combination of restated and originally reported data Because of restatements years cannot always be compared

Source International Rectifier Corporation
Annual Reports
DATAQUEST
May 1986

5. Market Analysis

5.1 Sales/Market Share by Product Category

(Please refer to Final Market Share Estimates)

5.2 Market Share and Growth

(Please refer to Final Market Share Estimates)

5.3 Major Competitors

IR encounters differing degrees of competition for its various products, depending upon the nature of the product and of the particular market served. The semiconductor industry is highly competitive and many of IR's competitors are larger firms with greater financial resources. The HEXFET competes both with bipolar transistor and power MOSFET manufacturers.

Major competitors in the power MOSFET market include:

1) Motorola
2) RCA Corp.
3) Siliconix Inc.
4) Siemens

Competitors in the very high power area include General Electric and Westinghouse Electric Corp.

5.4 Marketing Strategy

In 1985, International Rectifier reorganized its marketing and sales structure into four groups. Each of these groups is listed below with the respective key person.

(1) Government Operations & Military Sales
Bill Cordon, Vice President

(2) Electronic Products Group (MOSFET,HEXFET,Schottky)
Allen Tregidga, Executive Director

(3) Hybrid Business
Howard Abramovitz, Executive Director

(4) High-Power Products
Steph Prina, Executive Director

Mr. Derek Lidow supervises groups 1, 2, and 3 while Brian Pelly Vice President of High Power Products supervises group 4.
Other key positions within IR include Warren Totten as Marketing Administrator, Don Prescott as Vice President of Sales and Charles Fein as Distributor Director.

5.5 Channels of Distribution

A complete listing of the firm's sales offices can be found on the inside back cover of IR's 1986 annual report.

The Company's wholly-owned subsidiary in the Netherlands, B. V. Diode, has been distributor of electronic components in the Netherlands, Belgium, and Spain. A sizable portion of the assets of this subsidiary have been sold in 1986.

5.6 Major Applications

The applications of IR's products are varied and are described in each of the product categories in section 6.1 Key Products on page 11.

5.7 Export vs. Domestic

Domestic Sales: 58%
International Sales: 42% (Principally Europe)

Geographic Breakdown of Revenue 1984 - 1986
(In thousands of US dollars)

	1984	1985	1986
United States	$69,397	$78,717	$77,741
Europe	61,215	51,823	42,797
Other	6,211	5,036	4,512
	$116,706	$135,576	$145,167

5.8 Special Events

Oct. 20, 1986 - First quarter operating results ending Sept. 30, 1986; Sales $ 37,878,000. Net (loss) ($1,401,000.).

Aug. 27, 1986 - IR reduced employment by 10% through dismissals, early retirement, and 10% pay cuts for top executives.

March 1986 - IR stated that it was suffering a decline in semiconductor order levels in the commercial market, although shipments to the military market remained strong. The HEXFET line was maintaining its dominant share in the lover MOSFET market despite reduced orders.

Feb. 19, 1986 - IR begins construction of a new manufacturing facility (HEXFET America) which will produce power MOSFETs. Expected start-up date Jan.'87.

6. Products and Technologies

6.1 Key Products

High Power Products

IR designs, manufacturers and markets a broad range of High Power discrete semiconductors devices. These include silicon rectifiers, thyristors, modules combining two or more rectifiers or thyristors, and complex engineered assemblies manufactured to customer specifications. The Company produces a broad line of rectifiers and thyristors under the Power Matrix label.

IR's Schottky diodes allow the diode to perform at high temperatures and a line of conventional SSRs are marketed under the Crydom label. In addition, the firm has been engaged in power GTO devices (Gate Turn-Off) currently manufactured in Japan with plans to produce their own version domestically in mid-1987.

The Company's high power devices have a variety of industrial and military applications including motor and lighting controls, welding equipment, induction heating and power supplies.

HEXFET Power MOSFETs

Power MOSFETs were introduced in the mid-1970s as an alternative to bipolar transistors. Both devices are used in switching power supplies and motor speed controls and have applications in various types of equipment, such as computers and computer peripherals, telecommunication equipment and ignition systems.

The power MOSFET device is voltage controlled and offers several advantages over the conventional current-driven bipolar transistor. Power MOSFETs can be used with simpler external circuitry because they are voltage controlled and require only very small instantaneous currents from the signal source. In addition, they can achieve extremely fast switching speeds of less than 50 nanoseconds at high current levels and have excellent response time characteristics over a vide temperature range. They are also more rugged than bipolars and do not exhibit secondary breakdown. Initially power MOSFETs were limited by high on-site resistance per unit area of silicon, low voltage capability and high cost of production.

To overcome these limitations the Company developed the HEXFET device. Because the power MOSFET cannot be used in place of the bipolar transistor without changes in a product's circuitry, the HEXFET market can expand only as rapidly as nev products are designed or appropriate changes in existing products are made. Market acceptance and brand recognition of the HEXFET have been furthered by IR's emphasis on quality control and reliability.

Power Interface Circuits (PIC)

IR has introduced two families of PIC devices under the Crydom label. The first, the CHipswitch, is composed of two PICs and a gallium arsenide LED chip. The power integrated circuit chips are manufactured by the Company using CMOS technologies and offer significant performance advantages over the conventional AC solid state relays (SSRs). The Chipswitch is compact, reducing to three chips the approximately twenty circuit elements present in conventional SSRs. The chipswitch is used in gas pumps, traffic signals and cash dispensers, with future applications including computer peripherals and robotics.

The second PIC family of products is the PVR (photo-voltaic relay), which is usable with both direct and alternating currents and are marketed as replacements for reed switches in automatic test control, process control, instrumentation, multiplexing and telecommunications applications.

Custom Hybrids

In 1985, International Rectifier embarked upon a program to design and assemble custom power hybrid devices for major OEM customers. A team of experts in packaging, thermal management and associated hybrid skills along with a newly equipped facility was set up to be devoted specifically to this product area. These customized power devices are expected to offer design advantages by incorporating HEXFET and IR Schottky diode chips with parts manufactured by others in custom packages.

6.2 Second Source and License Agreement

In Oct. 1986, IR and National Semiconductor reached a five-year agreement calling for the two companies to share development efforts and exchange technology to make power intergrated circuits. National is to provide analog design and process technology while International Rectifier will provide competence in the power MOSFET field.

6.3 Product/Technology Highlights

June 27, 1986 - Centered-tapped Schottky Module applied to low voltage switches.

Feb. 27, 1986 - IR introduces first Power IC Relay for military market.

Feb. 11, 1986 - IR HEXFET Power MOSFETs break Bipolar Price Barrier.

Dec. 5, 1985 - IR introduces four nev Magn-A-Pak Power Modules

Nov. 11, 1985 - IR introduces SOT89 Surface-mount HEXFETs

Nov. 11, 1985 - IR introduces nev three-phase HEXFET Bridge

Oct. 9, 1985 - Government awards IR major patent on ChipSwitch power IC

Sept. 16, 1985 - IR adds 90V and 100V Schottky Rectifiers

7. Non-Semiconductor Products Summary

International Rectifier manufacturers semiconductors and related solid state devices including diodes, rectifiers, transistors and relays. In the key product section 6.1 each product catagory is summarized.

8. Dataquest Analysis

8.1 Long-term Outlook

1986 earnings have been declining sharply due to weak orders from commercial customers, aggressive price reductions, and the absence of a non-recurring gain. However, the introduction of important new products and a recovery in the industry should produce a sharp earnings recovery in fiscal 1987. IR could lose its position as the world's number one supplier of power MOSFETs, but will remain at least in second place. The future looks challenging but favorable for International Rectifier.

8.2 Challenges to Overcome

In order for IR to sustain long term growth it will have to face intense competition from Motorola. Also, IR will have to endure several years of low profitability until the power MOSFET supplier base shrinks during the 1987 - 1988 time frame.

8.3 Opportunities

IR is to open a 100 million dollar automated production facility within 1987 which will enable IR to compete aggressively in terms of both low price and large volumes of power MOSFETS.

This area of expertise in power MOSFETs can be drawn on as a route to the smart power market.

8.4 Strengths and Weaknesses (excluding technology)

IR's major strength is in the tremendous production and marketing capability of discrete semiconductors. IR's greatest weakness was their lack of knowledge in the manufacturing and marketing of integrated circuits. The recent joint venture with National Semiconductor could prove to be a valuable, mutually beneficial arrangement, however, right now there is no clear indication this venture will work. Currently, National Semiconductor is pursuing many such new arrangements of which not all will work. International Rectifier must continue to explore such arrangements with other semiconductor firms in its efforts to win a place in the smart power market.

9. Other Topics

9.1 Litigation:

In June this year IR renewed its legal battles with Siliconix, Inc. last week by filing a patent infringement lawsuit against the their competitor. The products in question are the highpower MOSFETs. IR's exclusive licensee is with Unitrode. Last year IR filed three other law suits against Siliconix over the use of IRF part numbers on certain MOSFETs.

Dataquest

a company of
The Dun & Bradstreet Corporation

SILICONIX INCORPORATED

COMPANY PROFILE

DATAQUEST

OCTOBER 1986

SEMICONDUCTOR INDUSTRY SERVICE

1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 971-9000 Telex 171973

SILICONIX

Table of Contents:

Siliconix Incorporated
2201 Laurelwood Road
Santa Clara, CA 95054
(408)988-8000

TWX 910-338-0227 FAX(408)727-5414

1. Executive Summary

Siliconix Inc. of Santa Clara, CA is something of an enigma to other Silicon Valley semiconductor companies. The company has reported profits every quarter for 21 years, refusing to sacrifice near-term profits in the hope of long-term success. Slow, steady growth, while turning down big contracts that would lead to rapid expansion is characteristic of the firm's management style. The firm is not greatly publicized by the media and keeps a low profile by not belonging to the Semiconductor Industry Association, the semiconductor industry's top trade group.

As a result of these characteristics, Siliconix has become a major player in certain segments of the industry and has established a healthy customer base world-wide with no single customer accounting for more than 10% of sales. Siliconix has been rated as an excellent low-risk way to buy a piece of the semiconductor business.

2. General Information

2.1 Company Background/History

Siliconix Incorporated was founded in March 1962, by a group of scientists and engineers from a number of semiconductor companies including Fairchild, Motorola, Pacific Semiconductor, Rheem, U.S. Semcor, Texas Instruments and Westinghouse.

The first devices offered by Siliconix were P-channel junction FETs, followed by N-channel junction FET, MOS FET and bipolar technology and applied it to a complete line of singles, duals, arrays and integrated circuits.

2.2 Major Milestones

1962 - Siliconix Incorporated was founded.

1970 - Five overseas subsidiaries were started.

1980 - Joint venture was established with Japanese sales agent.

1983 - Siliconix successfully combined IC and MOSPOWER technology to construct ICs that are known as SMARTPOWER.

1985 - Technical agreement with Seiko Epson licensing Siliconix to produce Seiko Epson's 1.5 and 2 micron CMOS gate arrays.

1985 - Completed first 6 inch wafer fabrication facility in Silicon Valley.

1986 - Siliconix entered into an agreement with SGS Microelettronica S.p.A of Italy to jointly develop next generation power MOSFETs

2.3 Management/Employees

As of December 31, 1985, Siliconix employed 2,587 employees in total with 1,200 working in the US, 774 in Hong Kong, 405 in Taiwan and 268 in Swansea, Wales.

There are no collective bargaining agreements between the Company and its employees. There have been no work stoppages due to labor difficulties and relations between management and employees is considered to be excellent.

2.4 Company Organizational Chart

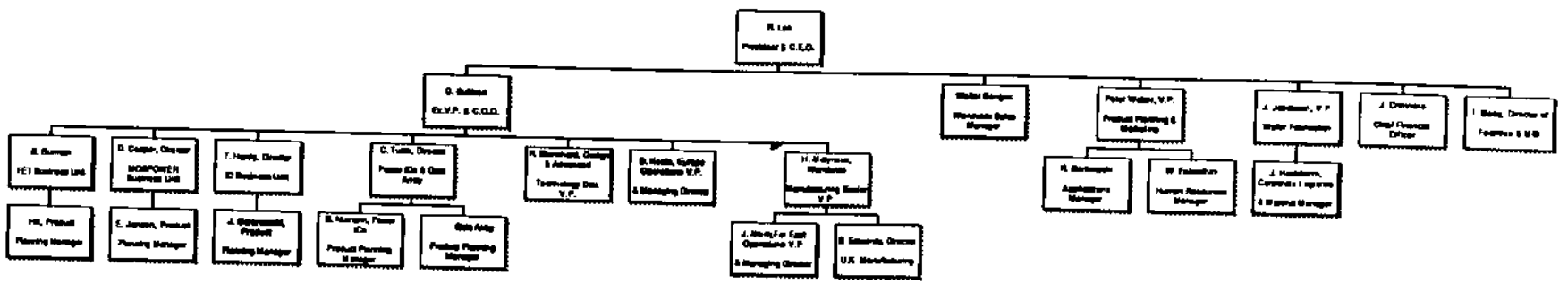
(Please see Figure 1, page 3)

2.5 Acquisitions and Mergers

Siliconix has not participated in any acquisitions or mergers to date. In 1983, the Transfer Radio Frequency group was sold to the PHI division of M/A Com Inc.

Figure 1

Organizational Chart of Siliconix Incorporated



3. Financial Information (for public companies)

3.1 Major Investors

Initially Siliconix's financial backing came from D.H. Baldwin Co., Electronic Engineering Company of California, and W. Van Alan Clark, Jr. of Sippican Corporation.

Currently, there are no intercompany relations other than Westinghouse Electric Corporation with 33% stock ownership and two directors are from Westinghouse. Other directors and officers as a group own 17% with the remaining 50% of shares floating. Shares owned by Westinghouse are for investment only, and are for sale. Westinghouse has turned down the opportunity to buy Siliconix in its entirety, however, General Electric, Harris, and Rockwell International Corp. are among a number of companies believed to be interested in acquiring a small semiconductor firm.

3.2 Balance Sheet/Income Statement

(Please see pages 5,6,7)

3.3 Financial Ratios

(Please see page 8)

Siliconix, Inc.

Siliconix, Inc.
2201 Laurelwood Road
Santa Clara, California 95054
(408) 988-8000
(Millions of Dollars Except Per Share Data)

Balance Sheet (December 31)

	1981	1982	1983	1984	1985
Working Capital	$ 16.2	$ 13.6	$ 19.3	$ 21.5	$ 41.0
Long-Term Debt	$ 5.7	$ 3.0	$ 0.1	$ 8.1	$ 40.2
Shareholders' Equity	$ 32.1	$ 32.4	$ 41.8	$ 46.3	$ 57.4
After-Tax Return on Average Equity (%)	0.4	2.2	23.7	19.1	17.5

Operating Performance (Fiscal Year Ending December 31)

	1981	1982	1983	1984	1985
Revenue	$ 60.1	$ 60.0	$ 69.6	$ 96.3	$ 108.0
U.S. Revenue	$ 35.8	$ 36.6	$ 46.3	$ 62.3	$ 67.6
Non-U.S. Revenue	$ 24.3	$ 23.4	$ 23.3	$ 34.0	$ 40.4
Cost of Revenue	$ 35.0	$ 31.9	$ 36.0	$ 46.5	$ 51.7
R&D Expense	$ 6.4	$ 7.6	$ 8.9	$ 11.9	$ 14.9
SG&A Expense	$ 16.4	$ 18.1	$ 20.0	$ 25.6	$ 27.0
Pretax Income	$ 0.2	$ 1.1	$ 11.8	$ 11.8	$ 12.6
Pretax Margin (%)	0.3	1.8	17.0	12.3	11.6
Effective Tax Rate (%)	44.8	36.0	30.1	28.8	28.0
Net Income	$ 0.1	$ 0.7	$ 8.8	$ 8.4	$ 9.1
Average Shares Outstanding (Millions)	5.19	5.76	6.17	6.18	6.21
Per Share					
Earnings	$ 0.02	$ 0.13	$ 1.43	$ 1.36	$ 1.41
Dividends	$ 0	$ 0	$ 0	$ 0	$ 0
Book Value	$ 6.18	$ 5.63	$ 6.77	$ 7.49	$ 9.24
Price Range	$ 7 3/8- 11 1/4	$ 5 3/4- 12 1/8	$ 8 3/4- 20 3/4	$ 11 3/4- 18 3/4	$ 13- 23 3/4
Total Employees	2,013	1,820	2,225	2,727	2,587
Capital Expenditures	$ 4.4	$ 3.8	$ 0.5*	$ 19.4	$ 32.3

*Net proceeds from land sales of $7.6 million cause the capital expenditure figure to appear deceptively low. Property additions amounted to $8.3 million in 1983.

Source: Siliconix, Inc.
Annual Reports
Dataquest
August 1986

Siliconix, Inc.

Table

Siliconix, Inc.
FINANCIAL STATEMENT HISTORY 1978-1985
(Millions of Dollars)

		Fiscal Year Ending December 31									
		1978	1979	1980	1981	1982	1983	1984	1985	CAGR	LSQR
BALANCE SHEET											
1	CASH & LIQUID SECURITIES	0.49	1.16	1.00	0.59	0.62	0.98	0.87	0.70	51.01	22.74
3	RECEIVABLES	9.39	12.50	14.50	14.46	11.11	14.73	15.48	22.02	12.96	8.44
4	INVENTORY	8.48	12.57	14.98	13.41	13.09	14.82	18.45	22.56	15.00	11.03
5	PREPAID EXPENSES	1.00	1.05	2.31	2.83	2.29	3.34	4.88	6.47	30.60	25.95
6	PREPAID INC TX/TX CREDITS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	TOTAL CURRENT ASSETS	19.36	27.08	32.56	31.29	27.02	33.87	39.48	59.76	17.47	12.11
9	GROSS P P E	23.95	31.55	38.23	41.57	43.39	49.34	66.19	98.25	22.34	18.69
10	ACCUMULATED DEPRECIATION	8.86	11.42	14.65	17.48	20.77	24.53	29.43	37.01	22.66	21.64
11	NET P P E	15.09	20.13	23.58	24.09	22.62	24.81	36.76	61.23	22.15	16.61
12	MISC ASSETS	0.32	0.13	0.15	1.48	1.44	1.43	0.68	1.54	25.29	36.02
15	*TOTAL ASSETS*	34.76	48.15	56.30	56.78	51.08	60.11	76.92	122.53	19.72	14.33
16	DEFERRED INC DISTRIB	1.20	3.54	7.13	5.99	6.50	2.11	5.12	2.71	12.34	4.86
17	ACCOUNTS PAYABLE	2.47	2.88	3.71	5.27	2.98	6.83	5.85	6.84	13.66	12.61
18	ACCRUED TAXES	1.55	2.84	1.97	0.45	0.00	1.15	0.00	2.62	7.72	9.00
19	ACCRUED LIABILITIES	2.16	3.05	2.73	3.21	3.68	5.29	7.73	7.27	18.91	19.92
20	CURR MAT LONG TERM DEBT	0.33	0.11	0.12	0.13	0.20	0.03	0.04	0.00	(16.51)	(18.86)
22	TOTAL CURRENT LIABILITIES	7.71	12.41	15.66	15.05	13.45	14.61	17.94	18.73	13.51	9.64
23	LONG TERM DEBT	6.98	5.24	6.02	5.75	2.96	9.13	8.15	40.19	28.42	2.86
24	DEFERRED CREDITS	1.95	2.24	3.44	3.00	2.27	3.58	4.57	6.20	21.98	16.52
25	MISC LIABILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	DEFICIT FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	TOTAL LIABILITIES	16.24	19.89	25.11	24.00	18.68	18.32	30.65	65.12	21.95	13.53
29	PREFERRED STOCK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	COMMON STOCK	6.85	12.73	13.20	14.95	14.55	16.12	17.24	19.59	16.20	11.98
31	CAPITAL SURPLUS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32	RETAINED EARNINGS	11.67	15.52	17.98	18.04	17.84	25.66	29.03	37.82	18.29	15.93
34	TOTAL EQUITY	18.52	28.26	31.18	32.00	32.40	41.79	46.27	57.41	17.54	14.36
35	*TOTAL LIAB & EQUITY*	34.76	48.15	56.30	56.78	51.08	60.11	76.92	122.53	19.72	14.33
36	NET WORKING CAPITAL	11.64	15.47	16.90	16.24	13.57	19.26	21.55	41.03	19.71	13.57
INCOME & EXPENSES											
38	SALES	43.20	54.34	66.11	60.10	60.03	69.56	86.36	108.02	13.99	11.86
40	COST OF GOODS	19.59	24.31	33.17	31.11	27.50	30.71	39.03	43.27	11.99	9.55
41	GROSS PROFITS	23.61	30.03	32.95	28.99	32.53	38.85	56.47	64.76	15.58	13.76
42	S G & A EXPENSE	11.30	12.93	16.13	17.10	18.05	19.75	25.58	27.04	13.27	12.88
43	R&D EXPENSE	3.90	5.97	7.08	6.41	7.58	8.93	11.00	14.00	21.00	17.68
45	OPERATING PROFIT	8.41	11.12	9.74	5.49	6.90	10.17	19.01	22.03	15.34	12.68
46	DEPRECIATION	1.74	2.95	3.74	3.85	4.43	5.13	6.47	8.18	24.76	20.76
47	LEASE PAYMENTS	0.00	0.00	0.00	0.00	0.00	0.17	0.19	0.29	0.00	0.00
48	INTEREST EXPENSE	0.54	1.04	1.00	1.74	1.43	0.28	0.54	1.26	12.78	(1.99)
49	MISC EXPENSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.00
51	DISCONT OPNS	0.00	0.00	0.00	0.24	0.10	7.21	0.00	0.00	0.00	0.00
53	PRETAX PROFIT	6.13	7.14	4.92	0.14	1.13	11.82	11.82	12.58	10.62	15.73
54	INCOME TAXES	2.82	3.03	2.20	0.10	0.40	3.58	3.41	3.52	3.23	6.07
55	LOSS (GAIN) DISC OPNS	0.00	0.00	0.00	0.00	0.00	(0.54)	0.00	0.00	0.00	0.00
56	NET PROFIT	3.31	4.10	2.72	0.04	0.72	8.81	8.41	9.06	15.48	22.64
57	EPS AFTER PFD DIVIDENDS	0.00	0.00	0.00	0.01	0.13	1.43	1.36	1.41	8.40	15.01
58	COMMON DIV PER SHARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Line 32 includes accumulated currency translation adjustments of $0.907, $1,429, and $2,202, in 1982, 1983, and 1984, respectively.

Source: Dataquest
August 1986

Siliconix, Inc.

Table

Siliconix, Inc.
FUNDS FLOW HISTORY 1978-1985
(Millions of Dollars)

		Fiscal Year Ending December 31									
		1978	1979	1980	1981	1982	1983	1984	1985	CAGR	LSQR
SOURCES											
56	NET PROFIT	3.31	4.10	2.72	0.04	0.72	8.81	8.41	9.06	15.48	22.64
46	DEPRECIATION	1.74	2.95	3.74	3.85	4.43	5.13	6.47	8.18	24.76	20.76
61	NEW LONG TERM DEBT	3.66	0.00	0.90	0.00	0.00	0.00	8.95	32.14	36.42	0.00
62	NEW EQUITY	0.27	5.63	0.21	0.87	(0.42)	0.38	(3.92)	2.08	33.73	0.00
63	INCR OTHER LIABILITIES	0.74	0.69	1.20	0.45	(1.62)	1.38	0.99	1.63	11.88	0.00
66	TOTAL SOURCES	9.72	13.38	8.77	5.21	3.12	15.82	20.00	53.09	27.45	19.77
USES											
67	P P E EXPENDITURES	7.26	0.00	7.19	4.35	2.96	7.32	18.42	32.64	23.95	18.64
68	REPAYMENT LONG TERM DEBT	0.09	1.96	0.11	0.26	2.72	2.99	0.03	0.04	(11.36)	(15.57)
69	PREFERRED DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	COMMON DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
71	INCR OTHER ASSETS	0.03	(0.18)	0.02	1.25	0.03	(0.01)	(0.75)	0.07	65.94	0.00
72	INCR WORKING CAPITAL	2.34	3.61	1.45	(0.65)	(2.60)	5.52	2.38	19.54	35.42	0.00
74	TOTAL USES	9.72	13.37	8.77	5.21	3.12	15.82	20.00	53.09	27.45	19.77
75	EXCESS/DEFICIT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
76	CUMULATIVE SUR/DEF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Line 32 includes accumulated currency translation adjustments of $0.907, $1,429, and $2,202, in 1982, 1983, and 1984, respectively.

Source: Dataquest
August 1986

Siliconix, Inc.

Table

Siliconix, Inc.
FINANCIAL RATIO HISTORY 1978-1985

		Fiscal Year Ending December 31									
		1978	1979	1980	1981	1982	1983	1984	1985	ST AVG	WT AVG
LIQUIDITY											
1	CURRENT RATIO	2.510	2.246	2.000	2.079	2.009	2.316	2.201	3.191	2.329	2.401
2	QUICK RATIO	1.200	1.101	1.001	1.000	0.873	1.075	0.000	1.641	1.109	1.131
3	CASH RATIO	0.063	0.004	0.000	0.039	0.046	0.007	0.037	0.405	0.110	0.145
4	WORKING CAPITAL/SALES	0.270	0.205	0.256	0.270	0.220	0.277	0.224	0.300	0.273	0.200
6	DAYS RECEIVABLES	79.322	83.950	80.574	87.020	87.500	77.297	58.062	74.421	76.200	73.505
7	DAYS INVENTORY	150.079	100.700	100.403	157.297	173.700	170.004	100.002	100.300	171.727	174.370
LEVERAGE											
8	LONG TERM DEBT/CAPITALIZ	0.274	0.150	0.102	0.152	0.004	0.003	0.150	0.412	0.174	0.179
11	LONG TERM DEBT/EQUITY	0.377	0.100	0.193	0.179	0.001	0.003	0.170	0.700	0.230	0.200
12	TOTAL DEBT/EQUITY	0.400	0.315	0.425	0.370	0.301	0.054	0.200	0.740	0.370	0.300
COVERAGE											
13	EBIT/INTEREST	12.300	7.000	5.500	1.001	1.704	43.000	23.045	11.002	13.334	15.070
14	FIXED CHARGE COVERAGE	12.300	7.000	5.500	1.001	1.704	27.073	17.343	9.144	10.373	11.002
16	REPAY LTD+FIX CHARGE COV	10.504	2.731	5.047	0.942	0.010	3.571	10.000	0.013	6.117	6.000
OPER PERFORMANCE											
17	GROSS PROFIT/SALES	0.547	0.553	0.400	0.402	0.542	0.500	0.500	0.500	0.546	0.507
18	OPER PROFIT/SALES	0.105	0.200	0.147	0.001	0.115	0.140	0.107	0.211	0.103	0.105
21	PRETAX PROFIT/SALES	0.142	0.131	0.074	0.002	0.010	0.170	0.123	0.110	0.007	0.000
22	NET PROFIT/SALES	0.077	0.075	0.041	0.001	0.012	0.127	0.007	0.004	0.003	0.000
23	NET PROFIT/AVG EQUITY	0.100	0.175	0.001	0.001	0.022	0.230	0.101	0.175	0.130	0.142
24	NET PROFIT/AVG CAPITALIZ	0.150	0.130	0.077	0.001	0.020	0.220	0.175	0.110	0.114	0.120
26	NET PROFIT/AVG TOT ASSETS	0.110	0.000	0.002	0.001	0.013	0.150	0.123	0.001	0.001	0.005
27	E P S GROWTH RATE	(0.363)	0.122	(0.307)	(0.007)	10.540	10.420	(0.047)	0.036	3.100	3.000
28	SALES GROWTH RATE	0.300	0.250	0.217	(0.001)	(0.001)	0.100	0.304	0.122	0.177	0.101
TURNOVER											
31	SALES/AVG EQUITY	2.502	2.323	2.224	1.000	1.002	1.075	2.107	2.004	2.130	2.057
32	SALES/AVG CAPITALIZ	1.000	1.042	1.070	1.002	1.040	1.000	1.000	1.421	1.707	1.723
33	SALES/AVG TOT DEBT + EQTY	1.047	1.003	1.020	1.300	1.304	1.014	1.050	1.350	1.302	1.304
34	SALES/AVG TOTAL ASSETS	1.434	1.311	1.200	1.003	1.113	1.251	1.400	1.003	1.241	1.213
35	SALES/AVG OPER ASSETS	1.440	1.310	1.200	1.070	1.143	1.204	1.420	1.000	1.250	1.233
36	SALES/AVG GROSS P P E	2.103	1.000	1.000	1.500	1.413	1.000	1.007	1.314	1.070	1.500
BALANCE SHEET											
37	CASH/SALES	0.011	0.021	0.010	0.010	0.010	0.014	0.007	0.001	0.021	0.027
38	RECEIVABLES/SALES	0.217	0.230	0.221	0.241	0.105	0.212	0.101	0.204	0.200	0.202
41	INVENTORY/SALES	0.100	0.231	0.221	0.223	0.210	0.213	0.102	0.200	0.213	0.211
42	OTH CURR ASSETS/SALES	0.023	0.030	0.035	0.047	0.037	0.040	0.001	0.000	0.041	0.047
44	GROSS P P E/SALES	0.554	0.501	0.570	0.002	0.723	0.700	0.007	0.000	0.670	0.727
45	LINE 13/SALES	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	MISC ASSETS/SALES	0.007	0.002	0.002	0.023	0.024	0.021	0.007	0.014	0.013	0.014
47	ACCOUNTS PAYABLE/SALES	0.057	0.053	0.050	0.000	0.050	0.007	0.052	0.050	0.002	0.003
48	ACCRUED TAXES/SALES	0.030	0.052	0.030	0.007	0.000	0.017	0.000	0.024	0.021	0.015
51	ACCRUED LIABILITY/SALES	0.000	0.050	0.041	0.053	0.051	0.070	0.000	0.007	0.001	0.000
53	DEFERRED TAXES/SALES	0.030	0.041	0.002	0.005	0.030	0.051	0.047	0.057	0.040	0.051
54	MISC LIABILITIES/SALES	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
56	LINE 26/SALES	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MISCELLANEOUS											
57	EQUITY PER COMMON SHARE	4.400	6.100	6.327	6.100	5.020	6.777	7.403	0.030	6.503	7.037
58	RETIRE/PREV GROSS P P E	(0.020)	(0.010)	(0.010)	(0.020)	(0.020)	(0.032)	(0.032)	(0.000)	(0.023)	(0.023)
61	DEPREC/PREV GROSS P P E	0.101	0.123	0.110	0.101	0.107	0.110	0.131	0.124	0.110	0.110
62	COM DIVS/ERN-PFD DIVS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63	TAX RATE	0.400	0.420	0.447	0.730	0.300	0.301	0.200	0.200	0.412	0.374
64	COST OF GOODS/SALES	0.453	0.447	0.502	0.510	0.450	0.441	0.414	0.401	0.454	0.443

Note: Line 32 includes accumulated currency translation adjustments of $0.907, $1,429, and $2,202, in 1982, 1983, and 1984, respectively.

Source: Dataquest
August 1986

4. Operations

4.1 Lines of Business

Since establishment Siliconix has sought to establish leadership positions in selected segments of the semiconductor market. These segments include field effect transistors, analog switch integrated circuits, smartpower devices, gate arrays and data converters. The company's products are listed as follows:

- Discrete Devices
  - .small-signal FETs
  - .MOSPOWER FETs
- Integrated Circuits
  - .Analog Switches
  - .Gate Arrays
  - .Data Conversions
  - .MOSPOWER support
  - .SMARTPOWER
  - .Other IC Products
    - .smoke detector ICs
    - .op amps
    - .micro-power linears and comparators

4.2 Semiconductor Revenue as Percentage of Total

Revenue and Percentage of Total Revenue for 1983 through 1985.
(Amounts in thousands of US dollars)

	1983		1984		1985	
ICs	$39,640	57%	$53,770	56%	$62,324	58%
Discrete Devices	29,295	42%	42,425	44%	45,480	42%
Other	630	1%	110	-	218	-
	$69,565	100%	$96,305	100%	$108,022	100%

Source: Siliconix Form 10K 1985

Dataquest's estmated semiconductor revenues for calendar years 1981 - 1985 by product are provided on page 10.

Siliconix, Inc.

Table

Siliconix, Inc.
ESTIMATED SEMICONDUCTOR REVENUE
(Millions of Dollars)

	Calendar Years				
	1981	1982	1983	1984	1985
Total Semiconductor	$60	$60	$68	$96	$114
Total IC	$35	$35	$39	$54	$ 66
MOS (all logic)	$12	$ 5	$14	$ 4	$ 3
Linear	$23	$30	$36	$50	$ 63
Total Discrete	$25	$25	$30	$43	$ 48
Small-Signal Transistors	$19	$15	$19	$24	$ 22
Power Transistors	$ 6	$10	$11	$19	$ 26

Source: Dataquest
August 1986

4.3 Manufacturing Locations/Plans

Assembly and testing takes place in the United States, United Kingdom, Hong Kong, and Taiwan. All wafer fabrication is performed at Siliconix's Santa Clara facility.

United States-Santa Clara; 220,100 square feet (50,000 square foot six inch wafer fabrication facility included)

United Kingdom-Swansea,Wales; 42,200 square feet

Hong Kong-Kwung Tong, Kowloon; 64,000 square feet

Taiwan-Nantze Export Processing Zone, Kaohsiung; 50,000 sq. feet

4.4 Capital Spending/ Research and Development

In 1985, engineering and development expenses were $ 14.9 million up 25.2% from 1984. 1986 engineering and development spending for the 1st and 2nd quarters was within the same range as 1985 with no significant decrease as a result of industry conditions.

Much effort has been expended on new ICs and power products. In the more mature product categories, small-signal FETs and analog switches, the major focus has been on performance and cost improvements for existing products.

5. Market Analysis

5.1 Sales/Market Share by Product Category

(Please see attached Preliminary Market Share Estimates)

5.2 Market Share and Growth

(Please see attached Preliminary Market Share Estimates)

5.3 Competition/Major Competitors

Siliconix has been able to compete successfully in the highly competitive semiconductor industry by being selective in its choice of products and markets, and by being a technology leader in those areas. Since the industry is characterized by rapid technological change and continuing reductions in product prices, Siliconix's ability to compete has been dependent upon its ability to respond to technological change, to continue to improve manufacturing processes and thus to reduce costs, and to develop new products.

Many of Siliconix's competitors are larger companies which have greater financial resources and are not dependent on semiconductor products as their sole source of sales and earnings. The major competitors are listed below by product category:

Siliconix's Major Competitor by Product Category

Discrete Devices (Small-signal transistors)
1)Motorola
2)National Semiconductor
3)General Electric
4)Sprague
5)Fairchild

Power Transistors (MOSFETs)
1)International Rectifier
2)Motorola
3)Siemens
4)General Electric /RCA
5)Supertex

Linear Integrated Circuits
1)Texas Instruments
2)Motorola
3)National Semiconductor
4)General Electric /RCA
5)Harris

5.4 Marketing Strategy

The firm's marketing strategy shoots for a broad customer base, currently Siliconix has over 2000 direct OEM accounts and 8000 other accounts are handled by distributors. A complete list of Siliconix's distributors is available on pages 101-108 in the publication "Siliconix Short Form/Summer 1986".

Strategically, Siliconix designs its products to surround microprocessor and memory microcircuits. The strategy prefers steady growth and selectivity in terms of customers, products, and markets, enabling Siliconix to avoid the tremors of periodic industry downturns. The firm uses its position as an industry leader in the analog-switch segment to maintain profitable sales to military, aerospace, and industrial customers.

A strong effort is being made to secure a share of the data conversion market, one of the company's three selected growth markets. Siliconix prides itself on new technology, and it uses laser trimming of on-chip resistors to develop highly accurate data conversion products. Because high-speed digital-to-analog (D/A) and accurate analog-to-digital (A/D) converters can both be built with on-chip analog switches and multiplexers, strategists at Siliconix view the data conversion market as a natural long-term extension of its existing product and design strengths.

The output of a microprocessor must be capable of producing useful work, which requires power levels beyond that which normal ICs can provide. Siliconix has employed their expertise in FET and MOS technology to make MOSPOWER FETs, which can be driven directly to by the low-power output of a microprocessor to drive output devices like displays, motors, and printers. New applications for MOSPOWER FETs and replacment of older bipolar products is expected to lead to high growth for this product line.

"SMARTPOWER" is still a relatively new area which Siliconix intends to be the leading player. The new 6 inch silicon wafer fabrication plant is the first to supply chips only for power devices. This will give Siliconix an edge over larger competitors.

5.5 Market Leadership Positions

Siliconix holds market leadership positions in linear ICs, discretes and power MOSFETs.

5.6 Channels of Distribution

Domestic sales accounts for 66% of total revenue and is conducted through 9 branch sales offices located in Santa Clara,CA; Tustin, CA; Downers Grove, IL; Waltham, MA; Westlake, OH; Altamonte Springs, FL; Carllton, TX; Ridgefield,CT; Englewood, CO.

Overseas sales accounts for 34% of total revenue and is conducted primarily through direct sales offices or distributors and agents. Sales offices are located in Newbury, England; Paris, France; Filderstadt and Munich, West Germany; Jarfalla, Sweden; Milan, Italy; Tokyo, Japan; Kowloon, Hong Kong; and Kaohsiung, Taiwan.

5.7 Major Application Areas

Industrial OEMs generate nearly half of Siliconix's sales, while military/aerospace firms provide one-third. There has been a gradual increase in the percentage of total sales garnered from four other markets; telecommunications, computer, consumer and automotive.

5.8 Merchant vs. Captive

Siliconix's products are sold solely to the merchant market through OEM accounts. Consumption for internal usage is negligible.

5.9 Export vs. Domestic

Export sales are a significant part of Siliconix's over all sales. In Western Europe sales are conducted through field sales offices and distributors while in other areas and in Israel stocking agents are utilized. Sales are expected to grow in this region as a result of Siliconix's tie-up with SGS of Italy.

In the Far East region sales are handled either directly through the Hong Kong office or by commissioned agents. In Japan business has been handled by a single importer, Tomen, however in 1980, this arrangement was converted into a joint venture using the Siliconix name and provides all maketing, sales, and customer support activities in Japan.

Geographic Breakdown of Sales Revenue
(Amounts in thousands of US dollars)

	1983		1984		1985	
U.S. & Canada	$ 67,574	63%	$62,268	65%	$46,334	66%
Western Europe	32,510	30%	25,855	27%	18,524	27%
Far East & Elsewhere	7,938	7%	8,182	8%	4,707	7%
	$108,022	100%	$96,305	100%	$69,565	100%

6. Products and Technologies

6.1 Key Products:

Siliconix's semiconductor products consist of two general types, discrete devices and integrated circuits.

DISCRETE DEVICES:

Business in this area has been concentrated in small-signal FETs (field-effect transistors) and a line of discrete power devices known as MOSPOWER FETs which may be used to generate, control, amplify or switch electronic signals; and both are connected with other electronic components to form electronic circuits for a wide variety of applications.

Small-signal FETs

Small signal FETs operate at relatively low levels of power are widely used components and are sold by the Company to a broad range of markets. Applications include high reliability military equipment, such as satellites and sonar; communication and navigation equipment and instumentation; and consumer products such as, automobile radios and smoke detectors.

The market for small-signal FETs has matured as more of the functions they perform are included in the design of integrated circuits. However, Siliconix intends to continue serving this market and plans for continued growth in sales coming from the withdrawal of competitors. The introduction of Siliconix's advanced technology DMOS devices in 1984, offering higher speed and performance, opened up new applications in the radio frequency, military and high performance market.

MOS Power FETs

MOS POWER FETs have a number of desirable attributes, including resistance to destructive self-overheating, very fast switching speeds, operating over a broad frequency range, low signal distortion and very high power gain. They may be used for many of the functions now performed by bipolar power transistors and, because of certain performance characteristics, for a variety of new applications. During 1984, Siliconix introduced a new product called the FETlington which is priced comparably with the older bipolar Darlington transistors. This signals the point where MOSPOWER technology begins to be cost competitive with bipolar. In 1985, the firm continued to expand its product line and achieved military qualification QPL (qualified product list) for ten products.

INTEGRATED CIRCUITS:

Siliconix manufactures both analog and digital ICs, as well as circuits which combine these technologies. Analog ICs are capable of handling continuously variable (analog) signals, while digital ICs respond to digital signals, which are simple "on-off" pulses.

Analog Switches

Siliconix's analog switch products are used for applications in which continuously varialbe functions are controlled by digital logic. These circuits are controlled electronically and can therefore switch signals much more rapidly and reliably than ordinary mechanical switches. Analog switches represent the largest portion of Siliconix's integrated circuit sales. A majority of the company's analog switch sales are for military and aerospace uses; the remaining sales are for telecommunications and other industrial uses. Applications include telephone switching equipment, industrial test equipment and telemetry systems.

Gate Arrays

During late 1982, Siliconix entered into an agreement with a third party to license its "liberty" of CMOS gate array designs or "cells". In 1985, this was complemented by a technology agreement with Seiko Epson allowing the firm to offer advanced technology high density products. The Company anticipates increased sales for these products in its traditional military/aerospace and industrial markets and is expanding the product line to include linear functions.

Data Conversions

Siliconix has made a major effort to expand its line of data conversion ICs, including D/A and A/D converters. These circuits are used to convert real world signals (which are analog) such as voice over a telephone or a position indicator, to digital signals that can be processed by a computer or microprocessor, or the reverse, to take digital signals and convert them to analog. During 1985, a wide range of products was introduced, giving Siliconix both "second source" products for immediate sales, and proprietary designs to provide for future growth.

MOSPOWER Support

Siliconix produces a line of ICs which are meant to drive its line of MOSPOWER transistors. These products include a driver used in bubble memories, switch mode regulator ICs, and motor drivers.

Other IC Products

Other IC products include smoke detector ICs, op amps, micro-power linears and comparators complementing the line of analog switches and data converters.

SMARTPOWER

SMARTPOWER combines the "smarts" of ICs with the "power" of MOSPOWER discretes into a single silicon chip. During 1984, the Company completed several custom development projects which not only proved certain aspects of the technology, but Siliconix believes this area will result in significant future sales. The new technology not only promises to displace existing devices, but will create new markets as well. The[A most significant aspect of this technology is the ability to combine high voltage devices with CMOS logic to efficiently control AC and DC power. Siliconix believes this capability opens the door to penetration of the electrical industry not previously served by semconductor technology.

6.2 Second source and License Agreements

Within the past few years Siliconix has become more agressive by entering into several agreements with S-MOS Systems, Seiko-Epson, and SGS Semiconductor Corporation.

S-MOS Systems, located in San Jose,CA, has been the US marketing channel for the Seiko Epson gate arrays and other CMOS digital chips for two years, and has developed CAD design software. This relationship put S-MOS in the position of go-between for a three-way renewable four year contract with Siliconix. The arrangement involves a transfer of the 2-micron CMOS processes and gate-array products developed by Seiko-Epson. This CMOS digital technology will be the "smart" part of a new line of smart-power devices Siliconix will design.

This year Siliconix signed an agreement with SGS Microelettronica S.p.A of Italy. The pact gives SGS needed technology for MOSFETs while Siliconix gains power plastic packaging technology, increased power packaging and test capacity, and an enlarged customer base. Both companies have started to identify and define the next generation of power MOSFETs and expect to get over 100 new parts on the market over the next two years.

Siliconix has second source arrangements with both SGS of Italy and Seiko Epson of Japan.

6.3 Product/Technology Highlights

As a result of the agreement with SGS, Siliconix will be introducing a series of n-channel MOSFET featuring easy-to-mount Isowatt 128 package identified by part numbers 2N7056 and 2N7059.

Siliconix's pact with Seiko Epson provided for automatic conversion to standard cell. Conversion of the gate array offerings should make ASIC end lines a significant contribution to Siliconix's over-all product mix.

7. Non-Semiconductor Products Summary

All of Siliconix's products are within the scope of the semiconductor industry.

8. Dataquest Analysis

8.1 Long-term Outlook

The future looks very favorable for Siliconix. The firm is well managed, their strategies are for the long term and are consistent in reaching the company's goals. One of which is to have more presence in Japan.

8.2 Challenges to Overcome

Challenges which Siliconix must overcome are competition from Motorola and International Rectifier, eroding profit margins, and downward trends in pricing.

In the area of power devices low profit margins are not tolerable and Siliconix needs to make efforts to drive out Motorola to gain larger market shares. Some type of link-up with an auto manufacturer would be advantageous for Siliconix to grasp a larger end user market share and to better understand application needs and trends.

8.3 Opportunities

Siliconix neds to increase their market share position however, moving from its current position of number three in the industry to number one would be too ambitious. A 20 to 25% increase would be ideal and increasing military contracts offers the greatest opportunites.

8.4 Strengths and Weaknesses (excluding technology)

Siliconix's strengths are in their ability to maintain profitability despite industry downturns. The management shows a certain dedication and good working spirit however, although conservatism has worked in Siliconix's favor, the firm may be a bit overly conservative.

Dataquest believes forging an alliance with a larger partner would strengthen Siliconix by providing capital and positioning the firm for taking on larger competitors. Steps in this direction have begun with Siliconix's recent tie-up with SGS of Italy.

The company shows some weaknesses in their analog devices but appears to be emphasizing development in the power device area, especially "SMARTPOWER".

9. Other Topics

9.1 In July, 1986 International Rectifier Corp. filed a lawsuit charging Siliconix with infringing on a patent involving high-power MOSFETs. Siliconix has filed their response to the U.S. District Court denying patent infringement. Siliconix believes the claim is invalid because the manufacturing technology involves existing art in the public domain and therefore unknown to the patent office. At this time an out-of-court settlement does not look probable.

9.2 Siliconix's Tokyo Office

Nippon Siliconix Incorporated
1-1 Uchisaiwai-cho 2-chome
Chiyoda-ku, Tokyo 100

Tel: 3-506-3490
TLX: J-23548

Dataquest

a company of
The Dun & Bradstreet Corporation

S G S

GROUP OF COMPANIES

COMPANY PROFILE

DATAQUEST
OCTOBER 1986
SEMICONDUCTOR
INDUSTRY
SERVICE

1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 971-9000 Telex 171973

SGS GROUP of COMPANIES

Table of Contents:

SGS Group of Companies
20041 Agrate Brianza (Mi)
Via C. Olivetti, 2

Tel:(039)6555.1/65.03.41 Telex: 330141 sgsagr

1. Executive Summary

SGS is an Italian based major multinational manufacturer of microelectronic semiconductor components and electronic systems producing more than 10,000 device types for use in telecommunications, computer, industrial, defense and consumer sectors. Over the past five years the company has successfully undergone a radical and substantial transition becoming a technology and service driven broad-range semiconductor supplier to the world's electronic markets.

In this report SGS Group of Companies or just SGS refers to the parent company based in Italy, while SGS Semiconductor Corporation is the wholly owned US subsidiary.

2. General Information

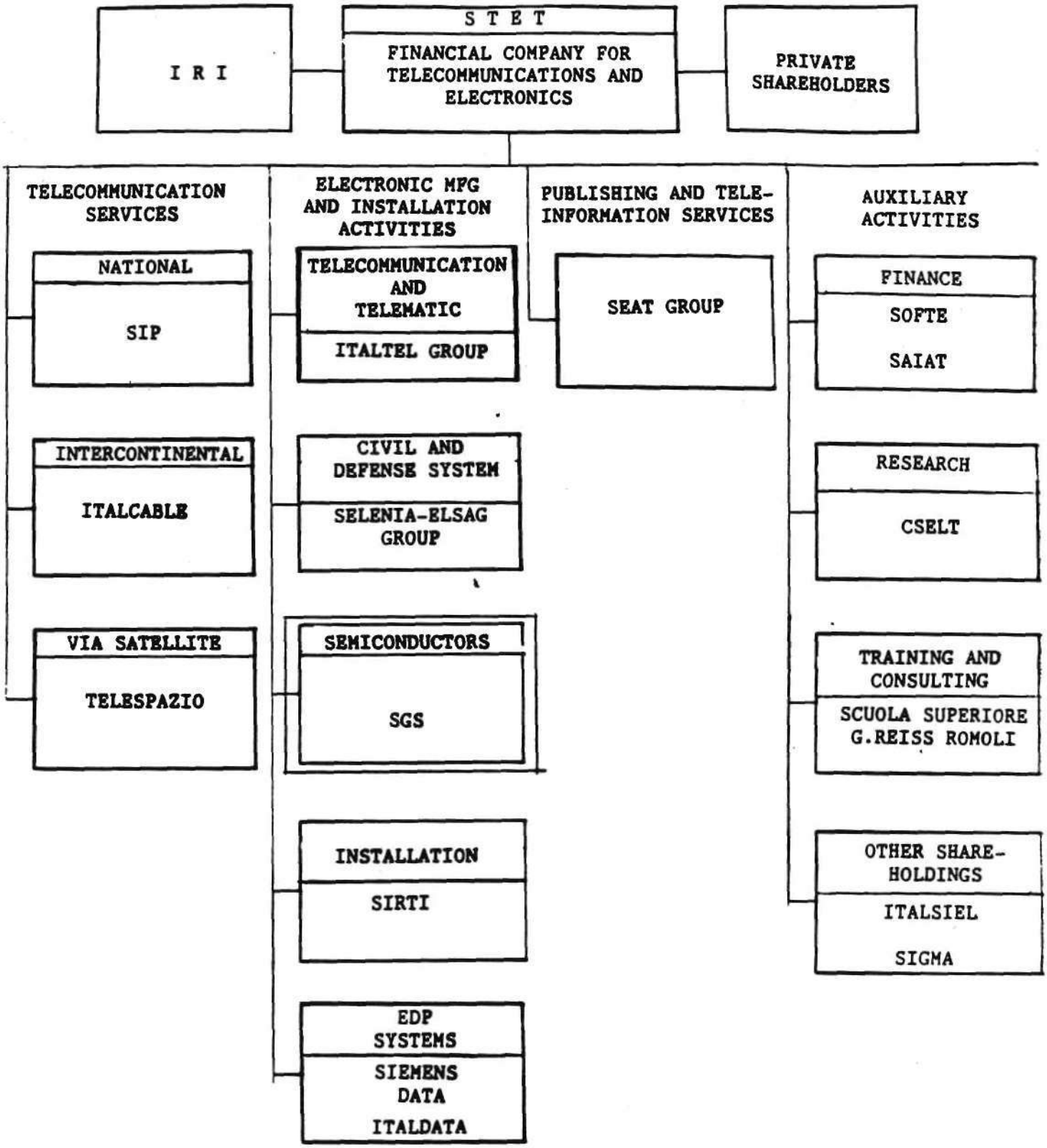
2.1 Company Background/History

The company was formed into SGS-Ates in 1972 by the merger of SGS and ATES, two established semiconductor companies. SGS, which dated back to 1957, was specialized in the production of advanced microcircuits and planar transistors, while ATES, founded in 1963 was specialized in the production of power transistors and linear ICs. In May 1985, the company changed its name to "SGS" matching its well established and recognized logo.

SGS is fully owned by STET a 7 billion dollar conglomerate operating in the field of communications and electronics and is the holding company for IRI (Istituto per la Ricostruzione Industriale). The chart on page 2 shows SGS's position within the group.

Historically, SGS has never enjoyed a substantial world semiconductor market position. In part, this was due to the to the original objective given to the company by its owners -- that SGS's role was to fulfill Italy's strategic and technological needs rather than to be a major international force. By 1980, both STET and IRI changed their philosophies radically, with the growing realization that semiconductor competence could only be achieved as a result of achieving world success. The message was becoming clear--unless SGS became a successful international semiconductor force, it would fail in its broader role of fulfilling Italy's technological needs.

THE STET GROUP



2.2 Major Milestones

1957 - Semiconductor production began

1961 - First planar transistor in Europe and second in the world

1965 - Production of integrated circuits began

1968 - First MOS calculator chip designed in Europe
- First monolithic audio power amplifier

1969 - Development of the Planox process (patented in 1971)

1972 - First fully protected linear power IC
- First MOS silicon gate process in Europe
- Mass production of microprocessors began

1975 - First 20W monolithic hi-fi amplifier

1977 - First planar 800V power transistor (using SGS patented Biplanar Technology)

1978 - First N-channel Non-volatile production

1979 - First commercially available PNP complementary switching high voltage high current power transistor

1980 - First 70W monolithic switch mode motor driver
- First 16-bit microprocessor in Europe

1981 - First low cost bipolar IC working on 200V supply

1982 - First 150W Monolithic Switch Mode Regulator

1983 - First Microprocessor with non volatile RAM Memory

1984 - First Monolithic High Voltage SLIC Kit

1985 - First DMOS-Bipolar compatible multipower process
First 5000V Power Transistor

2.3 Management/Employees

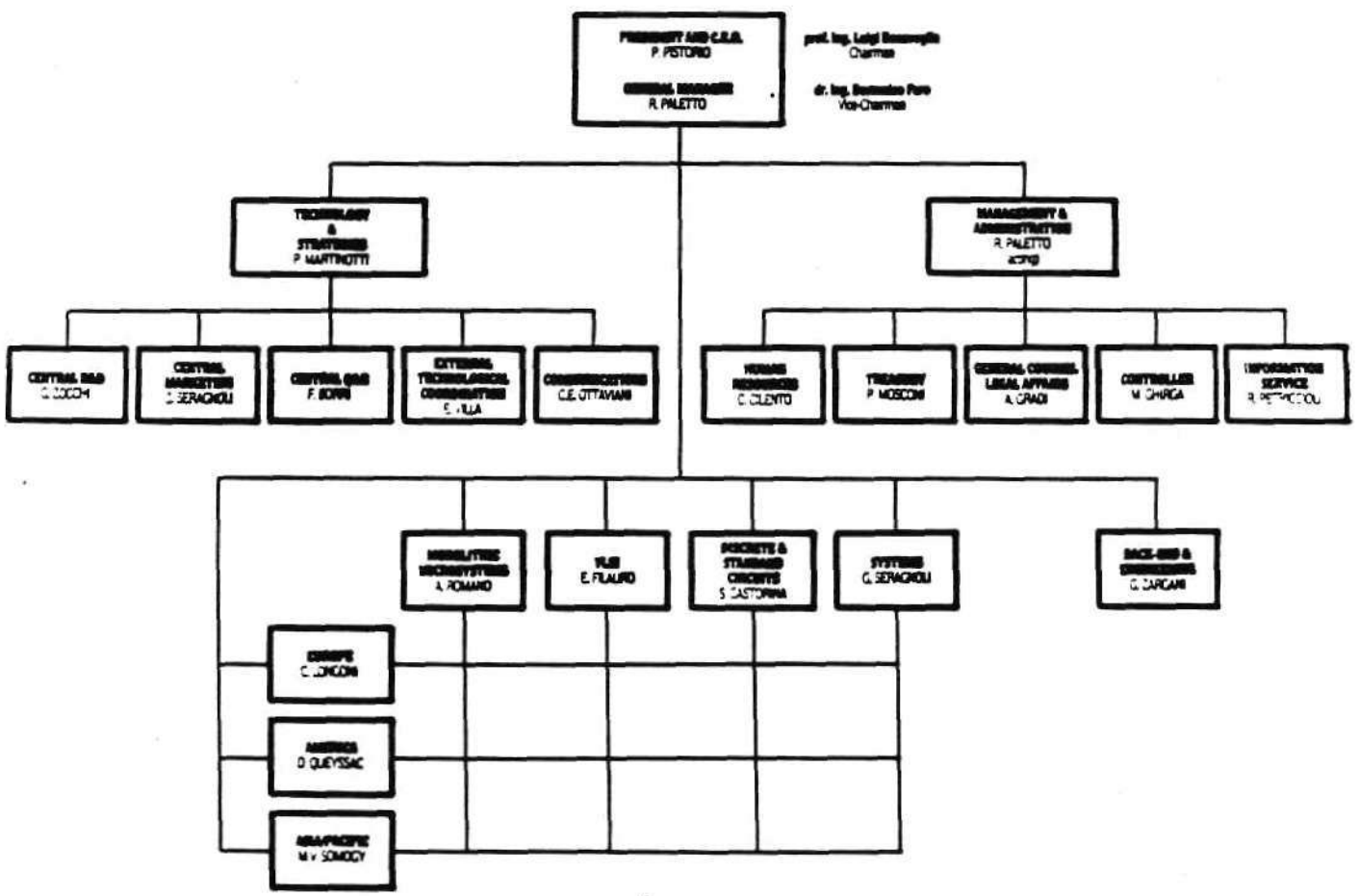
In 1980, Mr. Pasquale Pistorio left Motorola and became the Chief Executive Officer of SGS and brought about a dramatic turnaround within the Company.

Under Pistorio's leadership SGS was restructured from a vertical operation into a matrix type organization with four product areas, one assembly and test arm, and three regional areas. With this new structure, the heads of each area assume full profit and loss accountability and control of all the activities. (Please refer to the organizational chart on page 4)

SGS HISTORY

1957	SGS	TELETTRA	50%			
		OLIVETTI	50%			
		(FAIRCHILD TECHNOLOGY LICENSES)				
1960	SGS	TELETTRA	33%	1960	ATES	STET 100%
		OLIVETTI	33%			(RCA TECHNOLOGY
		FAIRCHILD	33%			LICENSE)
1968	SGS	OLIVETTI	66%			
		TELETTRA	33%			
1969	SGS	OLIVETTI	100%			
1972		SGS-ATES		STET	60%	
				OLIVETTI	20%	
				FIAT	20%	
1977		SGS-ATES		STET	100%	
1985		SGS		STET	100%	
1986		SGS ----→		SEMICUSTOM COMPANY		

THE ORGANIZATION



Key personnel who joined SGS after Pistorio took the helm include:

-Carlo Longoni (ex-AMD, Europe)

-Piero Martinotti (ex-Motorola, Europe; ex-Fiat, Italy)

-Salvatore Castorina (ex-Motorola, Europe)

-Maurizo Ghirga (ex-Exxon, Italy)

-Milvoy von Somogy (ex-Motorola, Europe)

Currently, SGS employs more than 9,000 employees worldwide.

2.4 Company Organizational Chart

An organizational chart of SGS's matrix type structure is provided on page 4.

SGS maintains an extensive worldwide network of companies. The main ones are as follows:

SGS Microelettronica S.p.A. (Italy)
SGS Semiconductor S.A. (Switzerland)
SGS International S.A. (Luxembourg)
Societe Generale de Semiconductors (France)
SGS Halbleiter Bauelemented GmbH (W. Germany)
SGS Semiconductor Limited (United Kingdom)
SGS Scandinavia AB (Sweden)
SGS Semiconductor Limited (Malta)
SGS Semiconductor Sdn Berhad (Malaysia)
SGS Semiconductor (Pte) Ltd (Singapore)
SGS Semiconductor Corporation (U.S.A.)
SGS Semiconductores Ltda (Brazil)
SGS Semiconductor Asia Ltd. (Hong Kong)

2.5 Brief History of US Operations

SGS was the first European semiconductor firm to establish a major investment in the U.S. SGS was incorporated in the state of Delaware in 1972 and operated a sales office in Waltham, MA. In 1980, Daniel Queyssac became president and launched an aggressive five year plan for the North American and Latin American markets. In 1983, SGS opened its North American headquarters and design center in Phoenix, AZ.

SGS Semiconductor Corporation USA
1000 East Bell Road
Pheonix, Arizona 85022
Tel:(602) 867-6100 TLX:249976 SGS PHUR

3. Financial Information (for public companies)

Due to SGS's group affiliations it is difficult to obtain complete financial information. The format of the following section has been changed to provide other relevant data.

3.1 Total Revenue

The total revenues in 1985 amounted to $306 million dollars, more than double in dollar terms compared to 1980. Although down from 1984 levels it is worth noting that SGS contained its 1985 billings downturn to just 9% compared with an overall market decrease of 18%.

The past five years have seen big changes in the geographic sales split and today around 80% of the company's revenues are generated outside Italy. Of particular interests is the fact that the USA and Asia today account for more than a third of the company's total revenues compared to 16% in 1980 underlining the companies commitment to these technologically advanced and competitive markets.

4. Operations

4.1 Lines of Business/Revenue

SGS's business is solely in the area of semiconductors and all revenue generated is related to this single business line.

4.2 Semiconductor Revenue as Percentage of Total

Financial information for this section is not publicly available.

4.3 Manufacturing Locations/Plans

Production facilities have been reorganized, modernized, automated, and streamlined to allow a concentration of volume on each product in each facility. This type of production reorganization enables SGS to keep the highly technological work in Italy and transfer the more labor intensive operations to lov cost areas. Furthermore, to ensure internal duplicated sourcing, the front-end operations has been introduced abroad. Diffusion in the Singapore and Rennes (France) facilities began in 1985.

(Please see pages 7 & 8 for a list of SGS's eight manufacturing facilities.)

SGS Group of Companies

- Catania (Sicily), Italy

Size	32,000 sq.m.
Number of employees	1,700
Year established	1960
Products/technologies	Discrete device and standard logic IC diffusion, assembly, testing and finishing; system production
Wafer capacity	70,000 wafers/month 4" equivalents
Wafer sizes	4 and 5 inches

- Toa Payoh, Singapore

Size	12,000 sq.m.
Number of employees	1,200
Year established	1969
Products/technologies	Assembly, testing and finishing of linear standard plastic packages and ceramic packages

- Ang Mo Kio, Singapore

Size	12,000 sq.m.
Number of employees	300
Year established	1984 (start-up date)
Products/technologies	Linear diffusion; Power diffusion
Wafer capacity	35000 wafers/month
Wafer size	5 inches

- Muar, Malaysia

Size	15,000 sq.m.
Number of employees	1,400
Year established	1974
Products/technologies	Assembly, testing and finishing of standard plastic packages,micropackages plastic power metal can small signal

- Kirkop, Malta

Size	11,600 sq.m.
Number of employees	750
Year established	1981
Products/technologies	Assembly, testing and finishing of linear power, MOS multileads, power plastic

SGS Group of Companies

- **Rennes, France**

Size	10,000 sq.m.
Number of employees	530
Year established	1964
Products/technologies	Diffusion, assembly, testing of linear ICs and discrete devices, high reliability production
Wafer capacity	10,000 wafers/month
Wafer sizes	5 inches

- **Phoenix, U.S.A.**

Size	17,000 sq.m.
Number of employees	200
Year established	1986 (start-up date)
Products/technologies	MOS IC diffusion
Wafer capacity	1,000 wafers/month
Wafer size	6 inches

- **Agrate Brianza (Milan) Italy**

Size	59,000 sq.m.
Number of employees	2,400
Year established	1957
Product/technologies	Linear and MOS IC diffusion, pilot assembly line, testing and finishing
Wafer capacity	80,000 wafers/month
Wafer sizes	4,5,6 inches

4.4 Capital Spending/Research and Development

SGS has always given high priority to R & D. Throughout the years, SGS has built up a strong team of scientists and development and application engineers. This team contributed to the Company's success in the early 1970s in the field of microprocessors, power linear ICs and power transistors.

The R&D group is currently concentrating, through its CAD/CAM system, on MOS technologies (NMOS and CMOS, as well as on linear and logic ICs, and power transistors. Other key areas are the development of packaging to meet high power dissipation, high density requirements, and surface mounting techniques.

Over the last five years the Company has invested an average of 13% of its annual billings in R&D in order to remain competitive with its product lines and technologies. In 1984 and 1985 capital investment represented more than 40% of total revenues.

The R & D centers in Italy are located in Agrate, for MOS devices; in Castelletto (near Milano) for bipolar linear devices; and in Catania where standard logic and power devices are developed. The American development center, that concentrated on state-of-the-art memory products and special VLSI projects, will soon be flanked by a larger center under construction near the headquarters's offices in Agrate, Italy.

The present network of regional design centers include France (Rennes), West Germany (Grafing), U.K. (Aylesbury), Sweden (Marsta), Singapore and the USA (Pheonix, AZ).

5. Market Analysis

5.1 Sales/Market Share by Product Category

SGS Group of Companies
Estimated Worldwide Semiconductor Revenues By Product Line
(Millions of U.S. Dollars)

	1981	1982	1983	1984	1985
Total Semiconductor	$160	$175	$230	$335	$306
Total Integrated Circuit	110	126	177	263	246
Bipolar Digital	14	5	10	20	29
MOS	33	45	68	102	88
Linear	63	76	99	141	129
Total Discrete	50	49	53	72	60
Transistor	50	49	53	72	60
Diode	-	-	-	-	-
Thyristor	-	-	-	-	-
Other	-	-	-	-	-
Total Optoelectronic	-	-	-	-	-
Exchange Rate	1,137	1,336	1,508	1,720	1,900

Source: DATAQUEST
1986

Of the three main semiconductor product groupings:

- Bipolar ICs represent 52% of revenues
- MOS ICs represent 28% of revenues
- Discrete components represent 20% of revenues

5.2 Market Share and Growth

(Please refer to Final Market Share Estimates attached)

5.3 Major Competitors

SGS's major competitors in Europe and one major Japanese competitor is listed below for the three main semiconductor product groupings:

BIPOLAR ICs: Linear ICs, digital bipolar families, custom, and semi-custom.

1) Philips-Signetics
2) Motorola
3) Siemens
4) Thompson
5) Fujitsu

MOS: Microprocessors, memories, dedicated devices, logic gate arrays, cells, custom using NMOS and/or CMOS technologies.

1) Inmos
2) Philips-Signetics
3) Thompson
4) Motorola
5) NEC

DISCRETE: Power and small signal transistors, diodes

1) Philips-Signetics
2) Motorola
3) Siemens
4) NEC
5) Toshiba

5.4 Marketing Strategy & Leadership Positions

SGS picked six product areas, together with a defined market objective, in which to concentrate its resources. These products areas and their corresponding market objectives include:

.Linear ICs - World Leadership

.Power Transistors - World Leadership

.N-Channel MOS - Strong microprocessor, ROM, EPROM, and non-volatile memory presence together with other dedicated circuits, for example telecommunication ICs.

.Si-Gate CMOS - Strong presence in innovative fast logic families (4000 series and 74HC), microprocessors, gate arrays, and other dedicated circuits, again telecommunications-focused.

.Bipolar and CMOS logic - Participation in the world markets for CMOS standard logic families.

.Small-signal metal can transistors - Commercial supremacy in a mature family with high returns.

In linear ICs, SGS presently enjoys world leadership in high-voltage devices i.e. subscriber line interface ICs (SLICs), RGB driver ICs, motor drive ICs, and a 200W switching power converter IC. In addition, developments are under way to combine CMOS, DMOS, I^2L, and linear power devices onto a single IC. In power transistors, SGS is particularly strong in epi- and multi epi-technologies, and a range of DMOS power devices.

Three market segments prioritized by SGS are:

* Telecommunications

* Industrial

* Automotive

By concentrating its resources in this way, SGS aims to exploit its existing strengths as the vehicle for immediate growth in sales dollars to embark on its corporate mission.

5.5 Market Leadership Positions

(See section 6.1 Key Products page 4)

5.6 Channels of Distribution

SGS's basic marketing structure is split in such a way as to cover the three major geographical regions: America, Asia/Pacific and Europe including all countries not covered by the other two areas.

With its full time sales and marketing staff SGS is present in 15 countries with 33 sales offices and 300 accredited representatives and distributors covering all the world's semiconductor markets.

5.7 Major Applications

SGS Group of Companies
Estimated Worldwide Semiconductor Revenues by End Use
(Millions of US Dollars)

	1981	1982	1983	1984	1985
Automotive	$ 6	$ 10	$ 10	$ 36	$ 29
Commercial & Industrial	40	44	65	99	85
Communications	23	26	35	55	49
Computer	14	19	21	59	62
Consumer	70	68	74	76	72
Government and Military	7	8	9	10	9
Total	$160	$175	$224	$335	$306
Exchange Rate (lire per US$)	1,137	1,336	1,508	1,720	1,900

Source: DATAQUEST

5.8 Merchant versus Captive

A considerable amount of sales is conducted within the STET group member companies. All other sales are to the merchant market sector only.

5.9 Export vs. Domestic

Estimated Worldwide Semiconductor Revenues by Region
(Millions of US Dollars)

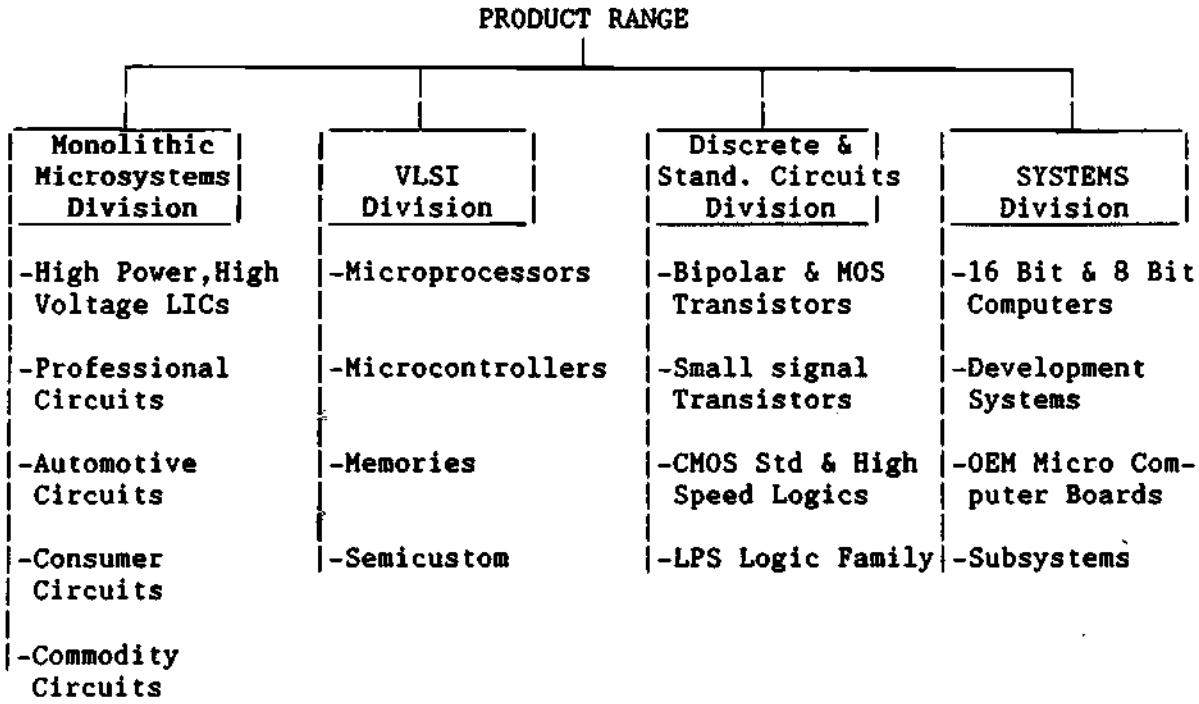
	1981	1982	1983	1984	1985
Benelux	$ 2	$ 3	$ 3	$ 5	$ 5
France	22	22	21	21	22
Italy	39	36	36	59	60
Scandinavia	9	8	10	16	19
United Kingdom	9	9	13	21	20
West Germany	27	30	30	49	64
Rest of Europe	10	10	9	9	11
Total Europe	$118	$118	$122	$180	$201
United States	26	37	68	95	60
Asia/Pacific	16	20	40	60	45
Total Worldwide	$160	$175	$230	$335	$306
Exchange Rate (lire per US$)	1,137	1,336	1,508	1,720	1,900

5.10 Market Highlights

(See Product and Technologies Section Below)

6. Products and Technologies

6.1 Key Products



The first sample made by SGS was of a high voltage subscriber line interface IC, an essential component in electronic telephone switching systems. Today, SGS offers all the components required to make a fully electronic telephone subset.

In the industrial sector, the company's leadership in product range has been confirmed with new products such as a power switching regulator, a stepper motor driver and a stepper motor controller.

The range of products dedicated to the automotive sector have been enriched with many new functions such as the L497, for Hall effect pick-up ignition, the ignition interface, the liquid level alarm and the injector solenoid driver.

6.1 Key Products (Continued)

Despite the current emphasis on the telecommunications and industrial markets, the range of products for the consumer sector has been renewed with new television products such as the 50/60HZ vertical deflection system and the east-west correction circuit. For the radio sector new products such as the TDA7230 stereo decoder plus audio amplifier and the LM1837 dual low noise preamplifier have been introduced.

The divisions product portfolio was also commercially strengthened with the expansion of the range of commodity devices covering voltage regulators, op-amps, comparators, etc.

SGS possesses a wide range of power technologies and in-house developed packages that have become industry standards. A major technological development of the year included a mixed technology which combines linear, CMOS and power DMOS circuits on a single silicon chip. This technology has been coined the term "Smart Power".

In the MOS field, particularly significant was the production start-up of the Z8003 virtual memory 16-bit microprocessor and the corresponding MMU, the Z8015.

Also significant in the micro sector has been the introduction on the market of the 38SH72, the first microcomputer designed expressly for use in the white goods sector.

Further notable progress has been made in the development of CMOS microprocessors and new CMOS microcontroller families using 1.5 micron N-Well technology are in advanced development stage. Another innovation has been the introduction of a cell library to allow fast design for customers MCUs.

In the memory sector, significant improvement has been obtained in the field of ROM and EPROM. The use of 2 micron technologies has allowed the realization of 128K and 256K devices.

During 1984 SGS began to substantially enlarge its capacity in this field offering the HGS3000, HGS5000, HGS7000 series of gate arrays which include up to 10,000 individual standard circuit elements on a single chip.

In the application specific sectors, the product portfolio in NMOS and CMOS technologies has been enlarged with new devices for the telecommunications and consumer sectors. These include a fully integrated MODEM and a digital timing system for television.

The CMOS M74HL series of High Speed Logic devices has been enlarged to include over 140 different types.

6.1 Key Products (Continued)

SGS believes that the successful supplier of power transistors must have a wide technology range, a variety of packages and a strong volume base to meet the financial cost/performance trade-offs in the many different applications.

The introduction of one new power transistor per day gave SGS a range of 1,000 standard power devices by the end of 1984.

Leading power technologies, including the Power MOS, have been developed allowing the integration on one chip of 800 volt power devices and low voltage control circuits.

3500 volt power transistors have already been developed in the laboratory giving SGS the possibility of meeting even the most stringent technological demands of today's market.

The discrete product range, which includes small signal and power transistors, has been extended to include fast switching power diodes, allowing SGS to offer a complete range of power semiconductor devices.

In the field of standard logic the introduction of advanced ion implantation processes has radically improved yields and production efficiency for LPS devices. New functions continued to be designed for this well established logic family.

6.2 Second Source and License Agreement

SGS has accumulated in the past years several important agreements. A technical collaboration agreement with Toshiba under which SGS received two high density CMOS processes, was followed by a second agreement under which SGS and Toshiba developed together a new high speed CMOS family 40% of which was entirely developed in SGS.

These agreements were particularly significant being the first ones signed between a leading Japanese semiconductor company and one of the most important European manufacturers in this field.

1985 saw the continuation of the close accord between Toshiba and SGS with the signing of a new agreement under which Toshiba is to second source a number of SGS telecommunications products. Further cooperation is envisaged on the design of new telecommunication devices.

Another important license agreement is that with Zilog to produce the Z8, Z80 and the Z8000 families.

SGS has signed agreements with LSI Logic, under which SGS became a licensed alternate source for LSI Logic's 3000, 5000 and 7000 series CMOS array families.

6.2 Second Source and License Agreement (Continued)

Reciprocal second source agreements for linear products have been signed with Silicon General, Unitrode and National Semiconductor.

This year SGS signed an agreement with Siliconix of Santa Clara, USA. The pact gives SGS needed technology for MOSFETs. Jointly, the two companies intend to get over 100 new parts on the market over the next two years.

6.3 Product/Technology Highlights

(See Key Product section 6.2 on page 14)

7. Non-Semiconductor Products Summary

SGS's entire product line falls into the semiconductor category. There are no significant non-semiconductor products.

8. Dataquest Analysis

8.1 Outlook

SGS aims to become a $1 billion company within a decade and if successful SGS can be envisioned to rank among the top 15 microelectronics suppliers in the world.

Notwithstanding the worldwide semiconductor crisis, SGS has continued to increase its market share in Europe raising its sales by 10% in 1985.

The company has an outstanding lead in design and production of high-power high-voltage integrated circuits, and is a worldwide leader in linear technology. The enormous influence of innovativeness in the linear-bipolar products is confirmed by the fact that 50% of their revenues in 1984 were from products not existing in 1980.

SGS is likely to move ahead of Thompson but has a long ways to go before acheiving the status that Seimens holds worldwide.

8.2 Challenges to Overcome

Dataquest believes it is vital for SGS to expand on a global basis by greater penetration into North America and the Far East via Japan. Other European firms such as Siemens and Thompson are currently pursuing this strategy.

SGS should recognize the need to become less dependent on Linear ICs and strengthen other product lines.

Alliances with other firms would strategically strengthen SGS's postiton overseas and add to developing other product lines.

8.3 Opportunities

The future looks good for Linear ICs and Power devices. SGS is strong in the high voltage linear market and should achieve full benefit from this position.

In the Power IC area SGS is already in a good position and should move ahead aggressively for growth and a larger market share.

8.4 Strengths and Weaknesses (excluding technology)

SGS is relatively unknown in the power supply field, with only one PWM device. However, it is well known in the peripherals motor-drive business, with three or four devices as standard products.

Also, it is a well known fact that SGS has diverted most of its resources to CMOS digital technology to gain a foothold in the digital IC market. The results have yet to be seen.

On a global basis SGS is relatively small sized, although its has a dominate presence in Italy. Under Mr. Pistorio's leadership SGS is definately headed for the bigger worldwide picture but it will take longer than originally intended.

9. Other

SGS was represented in Japan by Nihon Teksel Co. Ltd. for four or five years. In January this year SGS opened their own direct sales office in Tokyo.

SPRAGUE ELECTRIC COMPANY

COMPANY PROFILE

DATAQUEST

NOVEMBER 1986

SEMICONDUCTOR
INFORMATION
SERVICE

Sprague Electric Corporation

Table of Contents:

Sprague Electric Company Inc.
92 Hayden Ave.
Lexington, MA 02173

Tel: (617)862-5500

1. Executive Summary

Sprague Electric Company is a manufacturer of electronic and electrical circuit components and is owned 100% by GK Technologies Inc. The Company produces passive & active discrete and assembled components including transistors, power ICs, capacitors, resistors, and filters.

2. General Information

2.1 Company Background/History

Sprague Electric started as Sprague Specialties Company Inc. in January of 1926 by its founder Robert C. Sprague whose son, Dr. John L. Sprague, is currently president of the firm. On Dec. 6, 1976 General Cable Corporation acquired 93.5% of the outstanding shares of Sprague. General Cable Corporation's name was changed to GK Technologies Inc. in 1979. On April 25, 1979, GK Technologies Inc. formed a new wholly owned subsidiary Sprague Electric Company Inc.

On May 21, 1982, Sprague Electric Company Inc. was merged into Penncen Technologies Six Inc. and the name was changed to Penncen Sprague Inc. In March 1981, GK was acquired by Penn Central Corporation and as of May 27, 1982, Penncen Sprague Inc.'s name was changed back to Sprague Electric Company Inc. Today Sprague is a subsidiary of GK Technologies which is in turn a subsidiary of Penn Central Corporation.

On Dec. 31, 1985, Penn Central's sales were $2.5 billion dollars with a net income of approximately $1 million dollars.

2.2 Key Management/Employees

J. L. Sprague - President & Chief Executive Officer
D. P. Mc Guiness - Executive Vice President
L. K. Switzer - Senior Vice President of Finance and Administration
J. F. Darcy - Senior Vice President
D. B. Christiansen - Vice President & Controller
E. F. Kosnik - Executive Vice President, Penn Central Corporation
F. A. Kareken - Senior Vice President, General Counsel and Secretary, The Penn Central Corporation
H. S. Winokur Jr. - Senior Executive Vice President, The Penn Central Corporation

Currently, Sprague Electric Company employs 9,100 employees worldwide. 50 employees are employed at the corporate headquarters in Lexington,MA.

2.3 Company Organizational Chart

A current organizational chart of Sprague Electric is not available, however in September this year the firm regrouped its product divisions as follows:

Special Components Group
- Discrete Semiconductors
- Optoelectronics
- Hall-effect sensors
- Interference Filters
- Power Supply Magnetics

Advanced Ceramic Products Group
- Thick Film
- Multilithics

Capacitors Group
- Aluminum Electrolytic Capacitor
- Monolythic Capacitor
- Tantalum Capacitor
- Film Capacitor

Integrated Circuit Group
- Interface ICs
- Linear ICs
- CMOS Products

In January this year Penn Central shifted operating responsibilities for its Solid State Scientific Inc. (SSSI) subsidiary away from Sprague Electric Co. to its new Federal Systems Division. Sprague's Integrated Circuits Division will now consist of only the Worcester, MA bipolar and BiMOS IC operations. SSSI, which makes CMOS, logic memory, and ASICs, is planning to devote its energy to the government electronics market.

In August this year Sprague Electric Co.'s new Multilythics unit plans to start volume production of ASICs at its new 30,000 sq. ft. facility in Hudson, NH. Multilythics will manufacture custom circuits by integrating conductors, resistors, capacitors, and semiconductors onto a single-component package.

3. Financial Information (for public companies)

3.1 Major Investors

Sprague Electric Company is a wholly owned subsidiary of GK Technologies which in turn is a subsidiary of The Penn Central Corporation.

3.2 Balance Sheet/Income Statement

Fiscal Consolidated Statement dated Dec. 31, 1985
(Amounts in thousands of US dollars)

Cash	$ 5,400.	Accts Payable & Accrued Liabilities	$ 68,500.
Accts Received	65,900.	Taxes	400.
Inventory	129,000.	Long Term Liability(1yr)	1,000.
Prepaid Expenses	5,300.	Intercompany Pay	36,800.
Current Assets	$205,600.	Current Liabilities	$106,700.
Fixed Assets	202,700.	Long Term Dept	21,600.
Investments/Other	3,700.	Deferred Inc Taxes	1,300.
Intangibles	83,500.	Long Term Liability/Other	300.
Other Assets	700.	Common Stock	357,100.
		Translation Adjustment	(6,300.)
		Retained Earnings	15,500.
Total Assets	$496,200.	Total Liabilities	$496,200.

Year ended Dec. 21, 1985 Sales: $466,500.
Cost of Goods Sold: $377,500.
Gross Profit: $89,000.
Operating Expenses: $112,200.
Operating Income: ($ 23,200.)
Other Income: $ 500.
Other Expenses: $ 16,600.
Net Income before Taxes: ($ 39,300.) (Net Loss)
Retained Earnings at start: $ 55,100.
Other Deductions: $ 300.

Source: Dun & Bradstreet Inc.
1986

3.3 Financial Ratios

Not Available.

4. Operations

4.1 Lines of Business/Revenue

A break down of revenue by product line is not available however the Final Market Share Estimate statistics attached do serve as a basic indicator of the firm's stronger areas in terms of sales revenue.

4.2 Semiconductor Revenue as Percentage of Total

Not Available.

4.3 Manufacturing Locations/Plans

Sprague Electric has the following plant locations:

Hillsville, VA
Nashua, NH
Concord, NH
Sanford, ME
Visalia, CA
Worcester, MA
Lansing, NC
Longwood, FL
Wichita Falls, TX
Clinton, TN
North Adams, MA
Annapolis Junction, MD
Barre, VT
Brownsville, TX
Hudson, NH

4.4 Capital Spending

Not Available.

5. Market Analysis

5.1 Sales/Market Share by Product Category

(Please refer to Final Market Share Estimates attached)

5.2 Market Share and Growth

(Please refer to Final Market Share Estimates attached)

5.3 Major Competitors

Sprague's main competitors are primarily other power device manufacturers including:

1) Motorola
2) National Semiconductor
3) Texas Instruments
4) Unitrode
5) Fairchild

5.4 Marketing Strategy

It is hard to see a market strategy in Sprague's product groups. Through several acquisitions and mergers under GK Technologies and Penn Central, Sprague has had a hard time to charter any kind of solid direction.

5.5 Market Leadership Positions

Sprague has earned its reputation in the power IC arena. Targeted markets range from power op amps through power interface.ICs to switched-mode power supply circuits. Driven by the power interface segment, the company expects its interface business to grow in excess of a 25% compound annual growth rate over the next five years. Sprague also expects strong growth in the telecommunications market.

5.6 Channels of Distribution

A complete list of Sprague's worldwide sales offices is provided on page 6.

5.7 Far East Operations

Current information on Sprague's sales revenue by geographical region is not available to the public.

In the Far East Sprague operates their own sales office, Sprague Japan K.K., which was opened in June of 1980. This office in addition to handling sales activities also warehouses products assembled in Manila, quality control, and production of display and relay drivers. Sprague also has an investment in Nichicon-Sprague, a capacitor warehousing operation in Japan. Sanken Electric, which was marketing some Sprague semiconductors in Japan, continues to do so. In Singapore Sprague owns 60% of the Deltron-Sprague facility for IC production. In 1985, Sprague opened a 60,000 ft. plant in Hong Kong for production of capacitors and as a test facility for a wide variety of other components. It is estimated that Sprague's revenue from the Far Eastern region is approximately 10 - 12%.

6. Products and Technologies

6.1 Key Products

Long a manufacturer of linear ICs, Sprague makes perhaps the broadest line of transistors and Darlington arrays available. The Company's principle products include both linear and digital consumer ICs, with high-voltage and/or high-power content. Consumer ICs have been a major thrust of the company when it was able to take advantage of volume production capabilities. The firm is not known in the industry for its innovative product leadership, nor does it pursue military and custom business where a great amount of customer interaction and service is required.

Sales Offices

UNITED STATES

ALABAMA
EPI Inc.
Suite 64
3322 South Memorial Pkwy
Huntsville 35801 — 5335
Tel. 205/883-0520

ARIZONA
Sprague Electric Company
Suite 209 — 1819 S. Dobson Rd.
Mesa 85202 — 5690
Tel 602/244-0154
Tel 602/831-6762

Sprague Electric Company
Suite 601
1150 E. Pennsylvania Street
Tucson 85714 — 1640
Tel. 602/746-0955

CALIFORNIA (Metro. L.A.)
Sprague Electric Company
Suite B-12 — 3303 Harbor Blvd.
Costa Mesa 92626 — 1588
Tel. 714/549-9913

Sprague Electric Company
P.O. Box 6012
Inglewood 90312 — 6012
Tel. 213/649-2600

Mantronix
(Semiconductors only)
P.O. Box 1795
Fallbrook 92028 — 0930
Tel. 619/728-7678

Sprague Electric Company
Suite 126
4300 Stevens Creek Boulevard
San Jose 95129 — 1249
Tel. 408/241-7111

(Northern)
William J. Purdy Company
770 Airport Blvd.
Burlingame 94010 — 1927
Tel. 415/347-7701

(San Diego)
R. David Miner Inc.
Suite 219 — 10721 Treena Street
San Diego 92131 — 1009
Tel. 619/566-9891

COLORADO
William J. Purdy Company
5570 E. Yale Ave.
Denver 80222 — 6907
Tel. 303/753-6600

Todd & Fry Associates
(Semiconductors only)
P.O. Box 1689
Longmont 80502 — 1689
Tel. 303/776-7331

CONNECTICUT
Data Mark Inc.
(Semiconductors only)
47 Clapboard Hill Road
Guilford 06437 — 2261
Tel 203/453-0575

Sprague Electric Company
935 White Plains Rd.
Trumbull 06611 — 4547
Tel. 203/261-2551

DIST. OF COLUMBIA
Sprague Electric Company
Suite 311
14333 Laurel-Bowie Road
Laurel, MD 20708 — 1130
Tel 301/953-1717
Trinkle Sales Inc.
P.O. Box 5320
Cherry Hill, NJ 08034 — 0460
Tel. 609/795-4200

FLORIDA
Sprague Electric Company
P.O. Box 1410
Altamonte Spngs 32715 — 1410
Tel. 305/831-3636

Sprague Electric Company
Suite 419 — 1500 N.W. 62nd Street
Ft. Lauderdale 33309 — 1802
Tel 305/491-7411

Sprague Electric Company
Suite T, Building 501
8001 North Dale Mabry
Tampa 33614 — 3265
Tel. 813/935-8203

GEORGIA
Electramark Inc.
(Semiconductors only)
6030 — I Unity Drive
Norcross 30071 — 3583
Tel 404/446-7915

Electronic Marketing Associates
Suite 109
6695 Peachtree Industrial Blvd.
Atlanta 30360 — 2116
Tel 404/448-1215

ILLINOIS (Northern)
Sprague Electric Company
Suite 410 — 1480 Renaissance Dr.
Park Ridge 60068 — 1386
Tel 312/296-6620

(Southern)
EPI Inc.
Suite 201 — 103 W. Lockwood
St. Louis 63119 — 2915
Tel. 314/962-1411

INDIANA
Sprague Electric Company
P.O. Box 40308
Indianapolis 46240 — 4030
Tel 317/253-4247

KANSAS
EPI Inc.
10100 Santa Fe Drive
Overland Park 66212 — 4628
Tel. 913/648-4154

MARYLAND
Sprague Electric Company
Suite 311
14333 Laurel-Bowie Road
Laurel 20708 — 1130
Tel. 301/792-4890

Trinkle Sales Inc.
P.O. Box 5320
Cherry Hill, NJ 08034 — 0460
Tel. 609/795-4200

MASSACHUSETTS
Sprague Electric Company
10 Burr St.
Framingham 01701 — 4617
Tel 617/875-3200

Nova Sales Inc.
2 Militia Drive
Lexington 02173 — 4704
Tel. 617/861-1620

Sprague Electric Company
87 Marshall St.
North Adams 01247 — 2484
Tel 413/664-4411

Ray Perron & Co., Inc.
P.O. Box 389
Needham 02192 — 0009
Tel. 617/449-6162

MICHIGAN
Sprague Electric Company
Suite 301 — 2155 Jackson Road
Ann Arbor 48103 — 3917
Tel. 313/761-2014

MINNESOTA
HMR, Inc.
9065 Lyndale Ave. South
Minneapolis 55420 — 3520
Tel. 612/888-2122

MISSISSIPPI
EPI Inc.
Suite 64
3322 South Memorial Pkwy.
Huntsville, AL 35801 — 5335
Tel. 205/883-0520

MISSOURI
EPI Inc.
Suite 201 — 103 W. Lockwood
St. Louis 63119 — 2915
Tel 314/962-1411

NEW HAMPSHIRE
Ray Perron & Co., Inc.
1 Elm St.
Dover 03820 — 3910
Tel. 603/742-2321

NEW JERSEY (Northern)
Sprague Electric Company
P.O. Box 1612
Wayne 07470 — 0701
Tel 201/696-8200

(Southern)
Trinkle Sales Inc.
P.O. Box 5320
Cherry Hill 08034 — 0460
Tel. 609/795-4200

NEW MEXICO
William J. Purdy Company
120 LaVeta Drive NE
Albuquerque 87108 — 1813
Tel. 505/266-7959

NEW YORK (Downstate)
Sprague Electric Company
2001 Palmer Ave.
Larchmont 10538 — 2420
Tel. 914/834-4439

(Long Island)
Sprague Electric Company
P.O. Box 541
Central Islip 11722 — 0541
Tel. 516/234-8700

(Upstate)
Sprague Electric Company
2002 Teall Ave.
Syracuse 13206 — 1542
Tel. 315/437-7311

Paston-Hunter Co., Inc.
2002 Teall Ave
Syracuse 13206 — 1596
Tel. 315/437-2843

NORTH CAROLINA
Electronic Marketing Associates
9225 Honeycutt Creek Rd.
Raleigh 27609 — 1523
Tel. 919/847-8800

Sprague Electric Company
9741-M Southern Pine Blvd.
Charlotte 28210 — 5560
Tel. 704/527-1306

OHIO (Northern)
Electronic Salesmasters, Inc.
24100 Chagrin Blvd.
Beachwood 44122 — 5587
Tel. 1-800-362-2616

(Southern)
Sprague Electric Company
Suite 330 — 555 Metro Place North
Dublin, OH 43017 — 1375
Tel. 614/761-1881

OREGON
Sprague Electric Company
Suite H
16111 S.E. McGillivray Boulevard
Vancouver, WA 98664 — 9025
Tel. 503/225-0493
Tel 206/892-0361

William J. Purdy Company
7799 Southwest Cirrus Drive
Beaverton 97005 — 5945
Tel. 503/641-9373

PENNSYLVANIA
Trinkle Sales Inc.
P.O. Box 5320
Cherry Hill, NJ 08034 — 0460
Tel. Phila. 215/922-2080

SOUTH CAROLINA
Electronic Marketing Associates
210 W. Stone Ave
Greenville 29609 — 5499
Tel 803/233-4637

TENNESSEE (Eastern)
Electronic Marketing Associates
9225 Honeycutt Creek Road
Raleigh, NC 27609 — 1523
Tel 919/847-8800

(Western)
EPI Inc.
Suite 64
3322 South Memorial Pkwy.
Huntsville, AL 35801 — 5335
Tel 205/883-0520

TEXAS
Sprague Electric Company
Suite 220
9319 LBJ Freeway
Dallas 75243 — 3403
Tel. 214/235-1256

Sprague Electric Company
Suite 350W — 1106 Clayton Lane
Austin 78723 — 1033
Tel. 512/458-2514

UTAH
William J. Purdy Company
Suite 13 — 1817 S. Main St.
Salt Lake City 84115 — 2036
Tel. 801/486-8557

VIRGINIA
Sprague Electric Company
1 East Preston St.
Lexington 24450 — 2324
Tel. 703/463-9161

Sprague Electric Company
Suite 311
14333 Laurel-Bowie Road
Laurel, MD 20708 — 1130
Tel 301/953-1717

Trinkle Sales Inc.
P.O. Box 5320
Cherry Hill, NJ 08034 — 0460
Tel. 609/795-4200

WASHINGTON
Sprague Electric Company
3826 Woodland Park, North
Seattle 98103 — 7996
Tel. 206/632-7761

Sprague Electric Company
Suite H
16111 S.E. McGillivray Blvd.
Vancouver 98664
Tel. 206/892-0361
Tel. 503/225-0493

William J. Purdy Company
4082-148th Ave. N.E.
Redmond 98052 — 5165
Tel 206/882-3144

WISCONSIN
D. Dolin Sales
131 West Layton Ave.
Milwaukee 53207 — 5991
Tel. 414/482-1111

CANADA

Sprague Electric of Canada, Ltd.
Suite 220
2375 Steeles Avenue, W.
Downsview, Ontario M3J 3A8
Tel. 416/665-6066

CANADA (continued)
Sprague Electric of Canada, Ltd.
Suite 1610 — 85 Albert St.
Ottawa, Ont. K1P 6A4
Tel 613/238-2542

Lenbrook Electronics
Suite No. 2
13696 104th Ave
Surrey, B.C. V3T1W4
Tel. 604/585-9599

EUROPE

Sprague World Trade Corp.
18 Avenue Louis Casai
1209-Geneva
Switzerland
Tel. 98-4021
TLX 845-23469

Sprague Benelux
Excelsiorlaan 21
Bus 3
1930 Zaventem
Belgium
Tel 02/721 48 60
TLX 62897

Sprague Electric (U.K.) Ltd.
Saibrook Rd., Salfords
Surrey, England RH1 5DZ
Tel. 02934-5666
TLX 851-877813

Sprague France S.A.R.L.
3 Rue Camille Desmoulins
9430 Cachan
France
Tel. (1) 547-6600
TLX 250697

Sprague Elektronik GmbH
Postfach 700 848
D-6 Frankfurt/M
West Germany
Tel. 069-60551
TLX 414008

Sprague Italiana S.p.A.
Via G. DeCastro 4
20144 Milano
Italy
Tel. 02-498-7891
TLX 332321

Sprague Scandinavia AB
Box 54
S-182 71 Stocksund
Sweden
Tel. (04) 08-8502 20
TLX 854 15239

FAR EAST

Sprague World Trade Corp.
Eastern Branch
G.P.O. Box 4289
Hong Kong
Tel. 0-283188
TLX 43395

Sprague Japan K.K.
Shinjuku KB Bldg.
11-3, Nishi-Shinjuku 6-Chome
Shinjuku-ku, Tokyo 160
Japan
Tel. (03) 348-5221
TLX J23328

Tecnomil Ltd.
Sprague Korea Branch
4th Fl., Daiyoung Bldg.,
44-1, Yoido-Dong
Youngdungpo-Ku, Seoul, Korea
Tel. (2) 783-9784
TLX 78726186

Sprague World Trade Corp.
Singapore Office
11th Floor, 450/452 Inchcape House
Alexandra Road
Singapore 0511
Tel 475-1826
TLX RS 26384

Sprague Taiwan Branch/
Tecnomil, Ltd.
8/F, 142, Sec. 4
Chung Hsiao East Road
Taipei, Taiwan, R.O.C.
Tel. 771-9582
TLX 21422

North American Shipments of Linear ICs
(Amounts in Millions of US Dollars)

	1983	1984	1985
OEM Shipments			
Military	$ 1.27	$ 1.53	$ 2.03
Automotive	1.51	1.84	2.03
Computer	6.45	7.80	9.13
Industrial	0.88	1.07	1.02
Consumer	1.27	1.53	1.02
Communications	1.27	1.53	5.07
Total OEM	$12.65	$15.30	$20.30
Distribution			
Military	$ 5.75	$10.20	$10.50
Non-Military	4.60	8.50	4.20
Total Distribution	$10.35	$18.70	$14.70
Total OEM & Distribution	$23.00	$34.00	$35.00

Source: Dataquest Aug. 1986

One worldwide basis, Sprague sold $60 million dollars worth of linear ICs in 1985, nearly 70 percent of its total semiconductor revenues.

6.2 Second Source and License Agreement

In October 1974, Mostek Corporation signed an agreement with Sprague allowing Mostek to design and build MOS arrays at Sprague's IC facility in Worcester, MA. Thompson now owns Mostek and Sprague's 40% share was sold.

In April 1983,Sprague Electric Co. signed a technology-exchange agreement with Signetics for controller ICs used in switch mode power supplies.

Other second source arrangements are with Texas Instruments and SGS Semiconductor Corporation.

6.3 Product/Technology Highlights

Sprague Electric's new product offerings consist of the following:

Sept. 1986 - Low-cost versions of Sprague's Dual Solenoid Motor Driver.
Aug. 1986 - Optoelectric Switches are Integrated Twilight Sensors
June 1986 - New Motor Drivers offering Higher Power at Lower Cost
- New Smart-Power ICs are 1.5 A Latched Sink Drivers
July 1986 - New IC Can Source up to 16 A
- Modular Power supplies come in single/triple outputs
- New Motor Drivers for MIL-STD-883

May 1986 - New Advanced Ceramic Circuit Technology integrates Conductors, Resistors, Capacitors, and Semiconductors onto single chip
April 1986 - SIP Resistor Network for Military
- New Tantalum Capacitor becomes market leader
- SORN Surface-Mount Resistor Networks
- Temperature-Stable Hall Effect Switch
March 1986 - Resistor-Capacitor Networks & ECL Terminators in SIP Packages
- New Dual Full-Bridge Motor Driver
- New SIP CAP Networks

7. Non-Semiconductor Products Summary

Sprague Electric's main product lines are included within the semiconductor Industry.

8. Dataquest Analysis

8.1 Long-term Outlook

Sprague's future looks uncertain as they they make renewed efforts under their restructured organization. The regrouping appears to be pointing them in the right directions for markets that are expected to grow substantially.

It is questionable whether or not and when Sprague will regain profitability. The recent reorganization and down-sizing should provide the necessary boost. Financially, however, Sprague does have a cash rich parent company to provide support.

8.2 Challenges to Overcome

Some of the challenges facing Sprague are declining revenues in the passive component area i.e. capacitors and resistors. The firm must maintain a footing in power devices even as other large and start-up companies become more aggressive.

Demonstration of profitability to the parent company is becoming of greater concern throughout the semiconductor industry as a whole.

8.3 Opportunities

Sprague's shift into ASICs should open the door for a more customer oriented approach to business. Also, Dataquest believes Sprague can draw upon its expertise in high-power, and analog areas to increase business in the discrete device market segment.

The Company should benefit from staying in the linear market and the high voltage end of analog should continue to be stable.

8.4 Strengths and Weaknesses (excluding technology)

Again Penn Central is a financially strong parent company for Sprague. Over the years the firm has built up an extensive worldwide operation for global penetration.

The firm needs to move quickly to avoid going against the trend of custom and semi-custom production. More small volume sales from a customer driven market is taking shape throughout the semiconductor industry.

Dataquest
a company of
The Dun & Bradstreet Corporation

1290 Ridder Park Drive, San Jose, CA 95131-2398
(408) 971-9000 Telex 171973 Fax (408) 971-9003

SUPERTEX, INC.

Company Profile

Dataquest
November 1986

Semiconductor
Industry Service

Supertex, Inc.

Table of Contents:

SUPERTEX, INC.
1350 Bordeaux Drive
Sunnyvale, CA 94089

Tel:(408) 744-0100 TWX: 910-339-9388

1. Executive Summary

Supertex, Inc. designs, develops, manufacturers and markets semiconductor components utilizing advanced complementary metal oxide semiconductor (CMOS), double diffused MOS (DMOS), and high voltage MOS (HVCMOS), a design which merges CMOS and DMOS technologies. Supertex has been a pioneer in the development of each of these fields. The Company's principal product groups are CMOS integrated circuits, DMOS transistors, and HVCMOS high voltage integrated circuits. Supertex believes it is a leading producer of certain specialized CMOS semiconductors, DMOS transistors, and HVCMOS integrated circuits. The firm also fabricates integrated circuits to customer specifications and, in addition to its own research and development interests, conducts customer-funded projects as a resource for revenues.

2. General Information

2.1 Company Background/History

Supertex was founded in 1976 by Dr. Henry C. Pao and associates formerly with the Central Research Laboratory at Fairchild Semiconductor. About this time most of the semiconductor industry was focusing on NMOS technology while Mr. Pao believed that CMOS had a greater long term potential and would prove to be superior to bipolar technology. Supertex entered the semiconductor business as a custom wafer foundry for short term support while new CMOS and DMOS product families were developed. In 1977, the firm's first DMOS products were introduced for use in telecommunication systems. Supertex continues to maintain its foundry business while concentrating on marketing and further technological advancement of its three major product lines: CMOS ICs, DMOS discrete products, and HVICs. The Company's motto is "Success Through Innovation".

2.2 Management/Employees

Officers:
Dr. Henry Pao, President and Chief Executive Officer
Fred Tsang, Chief Operating Officer
Michael V. Bond, Vice President of Standard Products
Benedict C. K. Choy, Vice President of Technology and Development
Sandra A. Mora, Corporate Controller
Edward Mackenna, Vice President of Process Engineering
Richard E. Siegel, Vice President of Sales and Marketing

Directors:
Dr. John Bardeen
John B. Goodrich
George B. James
Dr. Henry C. Pao
Yun-Ni Pao

Currently the company has 211 full-time employees.

2.3 Acquisitions and Mergers

To date Supertex has no history of acquisitions or mergers.

3. Financial Information (for public companies)

3.1 Major Investors

Directors and Officers 20%
Exxon Corporation 12%
Frank Pao 10%
Employees and Family 35%
Other 23%

3.2 Balance Sheet/Income Statement

(Please refer to the 1986 Annual Report)

3.3 Sales Revenue Analysis

Fiscal 1986 net sales decreased 17.6% from fiscal 1985 sales primarily due to the ongoing recession in the semiconductor industry. While shipments of the Company's proprietary HVCMOS SMART POWER integrated circuits increased substantially in fiscal 1986 over the prior year, the revenue growth was not sufficient to offset the shortfalls in other product shipments. Net sales in fiscal 1985 increased 10.9% over fiscal 1984 primarily due to stronger demand of CMOS and DMOS products.

4. Operations

4.1 Lines of Business/Revenue

Revenue Distribution:

Year	Power Transistors	MOS Memory	MOS Logic
1984	23.1%	7.7%	69.2%
1985	27.34%	9.72%	62.84%
1986	26.4%	4.8%	68.8%

4.2 Manufacturing Locations/Plans

Supertex subcontracts most of its standard component packaging to independent assemblers, principally in the Philippines, Taiwan, and Hong Kong. The Company tests all products assembled offshore before shipment to customers. A specialized assembly area is maintained at the Company's manufacturing facilities to package engineering prototypes, to ensure high-priority deliveries, and to assemble high-reliability circuits required in military applications.

Production and Administration	38,000 sq. ft.	Sunnyvale,CA
Headquarters, Executive Offices, Sales & Marketing, Finance, Purchasing, Personnel, Design Engineering	34,000 sq. ft.	Sunnyvale, CA

Packaging is subcontracted in Taiwan, Hong Kong, and the Philippines.

4.3 Capital Spending/Research & Development

Supertex has concentrated its research efforts in the CMOS, DMOS, and HVMOS process technologies. The Company is now focusing on new product development and manufacturing process improvement. The trust of the Company is directed toward high voltage technologies.

Research & Development Expenditures
(Amounts in thousands of US dollars)

	1984	1985	1986
Research & Development	$ 3,428.	$ 4,581.	$ 2,381.

5. Market Analysis

5.1 Sales/Market Share by Product Category

(See Final Market Share Estimates)

5.2 Market Share and Growth

(See Final Market Share Estimates)

5.3 Major Competitors

Many of Supertex's domestic and foreign competitors have greater facilities, financial, technical, and personnel resources, and more diverse product lines. Such factors as product prices, product performance, diversity of product lines, delivery capabilities, ability to adapt to rapid technological change and develop new and improved products are important elements and methods of competition in the industry. Supertex competes by innovation and technological leadership and quality. Several of the Company's key competitors are listed below:

CMOS

1) Motorola
2) Siemens
3) Siliconix
4) International Rectifier

Potential competitors in the HVIC area include Texas Instruments, Sharp, Siliconix, Telmos, and Harris due to the fact that they currently have production capability.

5.4 Marketing Strategy

Amongst Supertex's top objectives are five sales/marketing goals which outline the firm's marketing strategy.

1) Keep a diverse market mix of products and customer base to avert cyclical market down-turns.
2) Establish production capacity from outside sources in addition to Mostek so that Supertex's capital equipment budget can be minimized.
3) Surpass industry standards of outgoing quality level of 400 ppm (parts per million).
4) Attain the highest customer satisfaction levels of 85% performance as scheduled (PAS).
5) To maintain market leadership positions in niche market areas such as HVMOS.

5.5 Market Leadership Positions

Supertex believes it is a technology leader in the emerging "Smart Power" markets, with such principal products as flat panel display driver circuits and ultrasonic scanner circuits. The Company's HVCMOS technology combines in a monolithic digital design the high performance and low power consumption characteristics of CMOS logic with DMOS high voltage drive capabilities. This design solution provides substantial performance and cost advantages over existing hybrid packages that require numerous integrated circuit and power transistor chips to perform the same functions.

Supertex believes that its HVCMOS technology will make flat-panel displays feasible for portable applications, including electroluminineseent, plasma, matrix liquid-crystal-display (LCD), and vacuum fluorescent technologies.

5.6 Channels of Distribution

Supertex believes that direct support is critical in the sale of its products, particularly where custom or semicustom solutions are required.

The Company markets its standard products in the United States through a broad network of direct sales personnel and through 19 manufacturer representatives in 36 locations and distributor support in 40 locations. Company's field managers are located in Southern California, Texas, and New Jersey.

On the international level, Supertex is represented by agents in Australia, Canada, Denmark, England, France, Germany, Israel, Italy, Japan, Korea, New Zealand, Norway, Spain, Sweden, Switzerland, and Taiwan.

Custom products, primarily HVCMOS products and wafer fabrication services, are marketed directly by the company.

Supertex's products are sold almost entirely to original equipment manufacturers. No one end-customer has accounted for as much as 10% of total net sales in any of the last three fiscal years.

In June of 1983, Supertex signed a franchise agreement with Integrated Electronics Corporation to sell the Company's complete line of CMOS logic, CMOS ROMs, power MOSFETs, integrated circuits.

5.7 Major Applications

Applications for Supertex's products are listed as follows:

CMOS	DMOS	HVCMOS
Microprocessor base systems	Telecommunications equipment	Flat panel displays (EL,LCD,plasma,VFD)
Portable data entry systems	Telephone handsets	Medical ultrasonic scanners
Portable computers and terminals	Automatic test equipment	Automatic test equipment
Military systems	Avionics	Facsimile machines
Fire/Security systems	Display Drivers	Inkjet Printers
	Inkjet and electro-static printers	

5.8 Merchant versus Captive

Supertex sells its products primarily through OEM sales channels in the merchant market. Key customers include Apple Computer, AT&T, Boeing, Dalmo Victor, GTE, Hughes Aircraft, ITT, Lohja, NEC, Rockwell International, Sanyo, Shimazu, and Siemens.

5.9 Export vs. Domestic

Export sales are made primarily through independent distributors to customers in Western Europe and the Far East. During fiscal years 1984 - 1986 export sales as a percentage of total revenue was as follows:

	1984	1985	1986
Western Europe & Far East	25%	25%	19%
Domestic	75%	75%	81%

5.10 Market Highlights

Please refer to page 8.

6. Products and Technologies

6.1 Key Products

HIGH-VOLTAGE ICs (up to 400v)
- Flat-Panel Display Drivers
- Serial-to-Parallel Converters
- High-Voltage Switches
- High-speed Non-impact printer and FAX Drivers
- N-channel and P-channel arrays

Discrete Devices (40v-50v)
- N-channel MOSFETs
- P-channel MOSFETs
- Depletion mode current source

STANDARD HCT CMOS Logic
- Decoders/demultiplexers
- Buffers/line Drivers
- Transceivers
- Latches
- Flip-flops
- Counters
- Switching Waveforms

Consumer ICs
- Encoders/Decoders
- Data Coders
- Detector ICs

6.2 Second Source and License Agreement

Lohja Corp. of Finland through its subsidiary Finlux Inc. jointly developed high voltage ICs with Supertex in 1985. Supertex then entered into an agreement allowing Mostek of Carrollton, TX to manufacture high voltage ICs using Supertex's HVCMOS "Smart Power" technology. Mostek is now owned by Thomson-CSF headquartered in Paris, France.

6.3 Product/Technology Highlights

Supertex's strengths are primarily in High Voltage products both discrete and integrated circuits. The firm holds patents for their silicon-gate DMOS power transistor technology as well as the high voltage ICs which merges CMOS and DMOS technologies on to one chip. In the discrete DMOS area Supertex has been working toward 100% improvement in density over the best in the market.

7. Non-Semiconductor Products Summary

All of Supertex's revenue is generated from semiconductor related business.

Supertex, Inc.

Highlights:

FY 1985

- Expenditure of $3 million on plant improvements and capital equipment
- Phase One construction of third fabrication line for high-voltage products
- Installation of state-of-the-art environmental control clean room systems
- Purchase and release to production of advanced test equipment
- Continued efforts in design, processing, and test engineering to assure improved yields
- Heavy investment in R&D efforts in DMOS and HVCMOS technologies

FY 1986

- Broadening of the HVCMOS product line
- Optimizing HVCMOS products for rapid production ramp-up due to high command
- Continued emphasis on R&D of niche-oriented DMOS and HVCMOS technologies and products
- Continued improvement and expansion of manufacturing operations
- Finalizing second-source manufacturing licensing agreements with Mostek for HVCMOS products
- Significant breakthroughs in new DMOS and HVCMOS technologies and design of many new products
- Plans for introducing a minimum of ten analog products in the next year, using HVCMOS technology
- Plans for raising present voltage limitation from 50V to 200V--a breakthrough in linear circuit technology

8. Dataquest Analysis

8.1 Long-term Outlook

The future for Supertex looks positive but challenging. The firm has been operating successfully for ten years in the semiconductor industry. The Company is considered a small size manufacturer, however, steady gradual growth is expected.

8.2 Challenges to Overcome

Since Supertex started out generating income from wafer fabrication to support its research and development efforts the firm tends to continue carrying the image of a small wafer fab. Efforts should be made to dispell this conception and a new identity as a technology leader in CMOS, DMOS, and especially HVICs should be established.

manufacturers by targeting areas where little competition exists. This will become increasingly more difficult as semiconductor firms merge and/or form strategic alliances. Supertex should consider the possibility of heading-off competition through forming a joint-venture or other alliance with a larger firm.

8.3 Opportunities

Supertex can and should continue to draw on their expertise in CMOS, DMOS and High Voltage. The firm is in line with prominent trends of the semiconductor industry segment.

The HVIC product area is expected to be a high growth market that Supertex would benefit by developing and pushing for a world leadership position. Supertex has a chance at becoming number one for smart power ICs for flat panel display applications.

8.4 Strengths and Weaknesses (excluding technology)

Strengths:

Supertex is well managed, opportunistic firm capable of responding to changes in the market. Since the beginning they have had the advantage of successful in-house wafer fabrication facility. Currently, production capacity is being control however should the need arise Supertex can fall back on this capability without making heavy capital expenditures.

Supertex's focus on CMOS, DMOS and HVICs has allowed the firm to position itself in high growth areas and is making efforts to expand and develop further expertise in these technological areas.

Weaknesses:

Because of the nature of Silicon Valley Supertex has occasionally been difficult for Supertex to attract and hold on to top notch engineers and skilled personnel.

Supertex needs to establish their image as a clear winner in one market segment while breaking into new grounds with newer technologies.

Supertex has yet to establish a strategic link-up with another semiconductor manufacturer or electronic OEM to strengthen its position against larger competitors.

Dataquest

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The Dun & Bradstreet Corporation

UNITRODE CORPORATION

COMPANY PROFILE

DATAQUEST
NOVEMBER 1986

SEMICONDUCTOR
INDUSTRY
SERVICE

1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 971-9000 Telex 171973

Unitrode Corporation

Table of Contents:

UNITRODE CORPORATION
Five Forbes Road
Lexington, MA 02173

Tel:(617) 861-6540 Telex: 95-1064

1. Executive Summary

Unitrode Corporation and its subsidiaries have distinguished itself as a manufacturer of superior electronic products for over twenty-five years. Unitrode's electronic components include Discrete Semiconductors, Ceramic Capacitors and EMI Filters, Data Conversion Devices, Analog ICs, and Switching Power Supplies.

2. General Information

2.1 Company Background/History

Unitrode Corporation was founded on Feb. 12, 1960, and was originally known as a supplier of specialty rectifiers primarily for the military. The founders are George M. Berman and Malcolm Hecht Jr. Mr. Berman is currently Unitrode's chairman and a director. Mr. Hecht is an attorney.

2.2 Major Milestones

Feb. 1960 - Unitrode was established

Nov. 1983 - Acquired US Microtek Components

Dec. 1983 - Acquired Power General Corporation

April 1985 - Purchased 18% of minority stock in Unitrode Integrated Circuits Corporation

(New product announcements are included in section 6.3)

2.3 Management/Employees

Unitrode currently employs approximately 2,695 employees worldwide compared to 3,120 at the beginning of 1985.

Key Management:

Chairman & Chief Executive Officer - George M. Berman
President - William B. Mitchell
Executive Vice President - Gerald C. Bellis
Senior Vice President, Finance & Treasurer - Walter B. Gates
Corporate Secretary - Richard S. Morse Jr.
Executive Vice President - Howard F. Wasserman
Vice President & Controller - William T. Campbell Jr.

2.4 Company Organization

Unitrode is currently going through a major restructuring and down sizing process. An up-dated organizational chart is not yet available.

2.5 Acqusitions and Mergers

On Oct. 11, 1983, Unitrode signed an agreement to acquire U.S. Microtek Components Corp., a manufacturer of ceramic capacitors located in Sun Valley, CA.

On Dec. 15, 1983, Unitrode completed its acquisition of Power General Corp., manufacturer of multiple-output switching power supplies up to 100 watts, and modular DC-DC converters up to 50 watts.

3. Financial Information (for public companies)

3.1 Major Investors

Officers and directors as a group own approximately 8.9% of the outstanding shares.

The following companies are reported to own more than 5% of the outstanding common stock as of April 11, 1986:

1) The Signal Companies, La Jolla, CA (19%)
2) Eaton Vance Management Inc., Boston, MA (7%)
3) The Equitable Assurance Society, New York, NY (5%)

3.2 Balance Sheet/Income Statement

(Please refer to pages 3 - 7)

3.3 Financial Ratios

(Please refer to page 8)

Unitrode Corporation

Unitrode Corporation
Five Forbes Road
Lexington, Massachusetts 02173
Telephone: (617) 861-6540 Telex: 95-1064
(Millions of Dollars Except Per Share Data)

Balance Sheet (January 31)

	1982	1983	1984	1985	1986
Working Capital	$ 26.7	$ 42.7	$ 55.9	$ 75.4	$ 76.1
Long-Term Debt*	$ 14.3	$ 15.1	$ 13.5	$ 11.3	$ 9.8
Shareholders' Equity	$ 59.1	$ 75.0	$ 95.6	$119.9	$132.9
After-Tax Return on Average Equity (%)	21.3	20.3	19.6	20.6	7.2

Operating Performance (Fiscal Year Ending January 31)

	1982	1983	1984	1985	1986
Revenue	$118.0	$131.1	$159.6	$200.1	$167.9
U.S. Revenue	$100.0	$118.6	$144.0	$179.9	$150.5
Non-U.S. Revenue	$ 18.0	$ 12.5	$ 15.6	$ 20.2	$ 17.5
Cost of Revenue	$ 63.6	$ 71.0	$ 87.0	$111.4	$102.3
R&D Expense	$ 5.6	$ 6.5	$ 8.8	$ 12.1	$ 12.5
SG&A Expense	$ 29.2	$ 31.7	$ 36.5	$ 42.5	$ 38.5
Pretax Income	$ 19.0	$ 21.1	$ 26.5	$ 33.2	$ 14.3
Pretax Margin (%)	16.1	16.1	16.6	16.6	8.5
Effective Tax Rate (%)	41.1	35.6	36.9	33.1	36.0
Net Income	$ 11.2	$ 13.6	$ 16.7	$ 22.2	$ 9.2
Average Shares Outstanding (Millions)	12.73	12.95	13.39	13.46	13.70
Per Share					
Earnings**	$ 0.88	$ 1.05	$ 1.25	$ 1.65	$ 0.67
Dividends	$ 0.13	$ 0.13	$ 0.16	$ 0.20	$ 0.20
Book Value	$ 4.64	$ 5.79	$ 7.14	$ 8.91	9.70
Price Range	$ 8.13-15.25	$10.69-23.88	$21.31-36.75	$22.00-33.75	$17.75-32.50
Total Employees	2,274	2,425	3,094	3,120	2,695
Capital Expenditures	$ 17.1	$ 14.6	$ 15.6	$ 12.7	$ 18.9

*Includes Industrial Revenue Bonds
**Includes $0.10 per share resulting from deferral of the DISC tax benefit, in 1985.

Source: Unitrode Corporation
Annual Reports
Dataquest
August 1986

Unitrode Corporation

Table 1

Unitrode Corporation
ESTIMATED CORPORATE REVENUES
(Millions of Dollars)

	Calendar Years				
	1981	1982	1983	1984	1985
Total Semiconductors	$ 89	$ 96	$106	$130	$128
Total IC (Analog)	-	$ 2	$ 4	$ 9	$ 6
Total Discrete	$ 70	$ 71	$ 77	$ 97	$ 98
Transistors	$ 9	$ 10	$ 15	$ 15	$ 22
Small-Signal	0	0	0	0	0
Power	9	10	15	15	22
Diodes	$ 52	$ 51	$ 56	$ 74	$ 68
Small-Signal	15	14	13	15	13
Power	29	29	34	48	45
Zener	8	8	9	11	10
Thyristors	$ 7	$ 8	$ 4	$ 4	$ 4
Other Discretes	$ 2	$ 2	$ 2	$ 4	$ 4
Hybrid ICs	$ 19	$ 23	$ 25	$ 24	$ 24
Other Revenues	$ 28	$ 34	$ 51	$ 67	$ 43
Total Revenues	$117	$130	$157	$197	$171

Source: Unitrode Corporation
Annual Reports
Dataquest
August 1986

Unitrode Corporation

Table 2

Unitrode Corporation
FINANCIAL STATEMENT HISTORY 1979-1986*,**
(Millions of Dollars)

		Fiscal Year Ending January 31									
		1979	1980	1981	1982	1983	1984	1985	1986	CAGR	LSQR
BALANCE SHEET											
1	CASH & LIQUID SECURITIES	7.76	7.28	2.97	5.39	11.77	8.57	13.12	9.59	3.09	10.51
3	RECEIVABLES	9.35	13.68	17.29	18.74	21.88	30.79	38.72	34.15	20.33	21.21
4	INVENTORY	10.59	19.82	20.46	21.68	30.96	40.31	50.31	51.22	25.25	24.09
5	PREPAID EXPENSES	0.24	0.54	0.41	0.54	0.68	1.68	1.13	0.91	21.34	23.30
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	TOTAL CURRENT ASSETS	27.94	41.12	41.13	46.35	65.27	81.33	103.28	95.88	19.26	20.44
9	GROSS P P E	21.73	34.71	43.53	55.86	71.18	86.11	98.36	114.76	26.84	25.60
10	ACCUMULATED DEPRECIATION	10.79	13.09	17.18	18.37	24.69	32.55	41.79	52.08	25.36	25.52
11	NET P P E	11.02	21.62	26.35	37.50	46.50	53.57	56.51	62.68	28.19	25.85
12	MISC ASSETS	1.80	0.27	2.72	8.13	1.54	1.68	1.27	3.13	7.55	10.26
13	ACCTS RECBLS > ONE YR	0.83	3.46	3.29	3.21	3.12	3.03	2.94	6.86	35.27	17.73
15	*TOTAL ASSETS*	41.66	66.47	73.49	95.19	116.42	139.61	164.00	168.54	22.10	21.60
16	DEFERRED INC DISTRIB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	ACCOUNTS PAYABLE	2.26	5.89	4.79	9.25	6.87	7.20	7.68	5.51	13.68	10.65
18	ACCRUED TAXES	2.49	3.82	1.86	3.20	4.44	5.21	4.11	0.65	(17.46)	(6.46)
19	ACCRUED LIABILITIES	2.22	1.29	2.32	2.94	3.68	5.17	8.10	6.81	15.28	25.87
20	CURR MAT LONG TERM DEBT	0.31	0.10	0.20	0.20	2.27	2.94	3.41	4.26	45.54	52.39
21	OTHER CURRENT LIABILITIES	0.00	2.39	3.69	4.78	5.31	4.88	4.58	3.33	0.00	0.00
22	TOTAL CURRENT LIABILITIES	7.27	13.49	20.85	20.37	22.57	25.49	27.89	19.77	15.36	14.43
23	LONG TERM DEBT	0.51	0.00	0.00	0.10	0.74	1.74	2.06	1.23	13.24	0.00
24	DEFERRED CREDITS	0.56	0.99	1.86	2.71	3.67	5.06	4.84	6.84	40.47	39.40
25	MISC LIABILITIES	1.25	2.15	4.95	14.25	14.46	11.79	9.27	8.58	31.69	32.14
27	DEFICIT FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	TOTAL LIABILITIES	9.60	16.63	27.66	37.42	41.36	43.98	44.06	35.63	20.61	20.33
29	PREFERRED STOCK	0.00	(4.14)	(3.91)	(2.99)	(2.18)	(1.21)	(0.24)	(3.41)	0.00	0.00
30	COMMON STOCK	0.52	0.62	0.63	1.26	1.36	2.74	2.74	2.74	26.92	32.41
31	CAPITAL SURPLUS	4.23	18.82	18.28	16.77	18.96	20.36	22.25	27.73	30.80	18.77
32	RETAINED EARNINGS	27.77	34.63	43.52	53.33	65.41	80.17	99.77	108.23	21.12	22.02
33	CUM TRANSL ADJ	(0.46)	(0.18)	(12.62)	(10.64)	(8.52)	(6.44)	(4.57)	(0.36)	(3.58)	(19.55)
34	TOTAL EQUITY	32.06	49.84	45.83	57.76	75.83	95.63	119.94	132.92	22.52	22.16
35	*TOTAL LIAB & EQUITY*	41.66	66.47	73.49	95.19	116.42	139.61	164.00	168.54	22.10	21.60
36	NET WORKING CAPITAL	20.66	27.63	20.28	25.98	42.70	55.94	75.40	76.11	20.47	23.44
INCOME & EXPENSES											
38	SALES	50.59	81.61	103.80	118.84	131.13	159.57	208.11	187.97	18.78	18.54
40	COST OF GOODS	27.75	42.75	51.80	56.51	62.56	78.55	99.93	87.38	17.79	17.56
41	GROSS PROFITS	22.84	38.86	52.00	61.53	68.57	83.02	108.19	80.67	19.75	19.82
42	S G & A EXPENSE	10.83	18.73	25.54	29.19	31.67	36.54	42.49	38.45	19.84	18.30
43	R&D EXPENSE	1.26	1.79	3.10	5.56	6.58	8.81	12.12	12.47	38.75	41.06
45	OPERATING PROFIT	10.75	18.33	23.96	26.76	30.30	37.67	45.58	29.74	15.65	16.96
46	DEPRECIATION	1.65	3.24	4.30	5.53	6.68	8.45	9.98	13.57	32.93	29.51
47	LEASE PAYMENTS	0.35	0.58	1.02	1.56	1.74	2.00	1.47	1.45	22.54	22.00
48	INTEREST EXPENSE	(0.24)	(0.32)	0.41	0.66	0.78	0.69	0.00	0.40	0.00	0.00
49	MISC EXPENSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	DISCONT OPNS	0.36	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53	PRETAX PROFIT	9.19	14.98	18.15	19.80	21.19	26.53	33.22	14.33	6.62	10.51
54	INCOME TAXES	3.94	6.63	7.83	7.81	7.95	9.79	11.91	5.17	3.95	6.22
55	LOSS (GAIN) DISC OPNS	(1.71)	0.00	(0.09)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	NET PROFIT	6.92	8.27	10.40	11.19	13.64	16.74	22.21	9.16	4.09	10.69
57	EPS AFTER PFD DIVIDENDS	0.66	0.68	0.84	0.88	1.05	1.25	1.65	0.67	0.14	7.23
58	COMMON DIV PER SHARE	0.04	0.13	0.13	0.13	0.13	0.16	0.20	0.20	26.78	19.21

Source: Dataquest
August 1986

Unitrode Corporation

Table 3

Unitrode Corporation
FINANCIAL STATEMENT HISTORY 1979-1986*,**
(Percent)

		Fiscal Year Ending January 31									
		1979	1980	1981	1982	1983	1984	1985	1986	CAGR	LSQR
BALANCE SHEET											
1	CASH & LIQUID SECURITIES	18.61	10.96	4.04	5.66	10.11	6.14	8.00	5.69	(15.57)	(9.12)
3	RECEIVABLES	22.44	29.58	23.52	19.69	18.79	22.66	23.61	20.26	(1.45)	(0.32)
4	INVENTORY	25.43	29.52	27.84	22.77	26.60	28.87	30.68	30.39	2.58	2.85
5	OTHER CURRENT ASSETS	0.57	0.81	0.56	0.57	0.57	1.19	0.69	0.54	(0.62)	1.40
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	TOTAL CURRENT ASSETS	67.05	61.86	55.97	48.70	56.06	58.26	62.98	56.88	(2.32)	(0.95)
9	GROSS P P E	52.15	52.22	59.23	58.69	61.14	61.68	59.94	60.09	3.88	3.29
10	ACCUMULATED DEPRECIATION	25.69	19.76	23.37	19.29	21.20	23.31	25.48	30.90	2.67	3.22
11	NET P P E	26.45	32.53	35.86	39.39	39.94	38.37	34.46	37.19	4.99	3.58
12	MISC ASSETS	4.51	0.41	3.69	8.54	1.32	1.21	0.77	1.85	(11.91)	(9.33)
13	GOODWILL	1.99	5.20	4.48	3.37	2.68	2.17	1.79	4.07	10.79	(3.18)
15	*TOTAL ASSETS*	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	(0.00)
16	NOTES PYBLE & CURR LTD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	ACCOUNTS PAYABLE	5.42	8.87	6.51	9.72	5.90	5.15	4.48	3.27	(6.96)	(9.00)
18	ACCRUED TAXES	5.97	5.74	2.52	3.36	3.81	3.73	2.51	0.39	(32.48)	(23.07)
19	ACCRUED LIABILITIES	5.33	1.94	3.16	3.09	3.16	3.79	4.94	3.57	(5.59)	2.85
20	CURR OBL CAP LEASE	0.74	0.15	11.16	0.21	1.95	2.11	2.08	2.53	19.20	25.33
21	OTHER CURRENT LIABILITIES	0.00	3.00	5.02	5.02	4.56	3.49	2.79	1.98	0.00	0.00
22	TOTAL CURRENT LIABILITIES	17.46	20.29	28.37	21.40	19.39	18.19	17.00	11.73	(5.52)	(5.89)
23	LTD & NONCURR CAP LSES	1.23	0.00	0.00	0.10	0.63	1.24	1.26	0.73	(7.26)	0.00
24	DEFERRED TAXES	1.34	1.49	2.53	2.84	3.16	3.63	2.95	3.59	15.85	14.64
25	MISC LIABILITIES	3.00	3.23	6.74	14.97	12.37	8.44	5.65	5.10	7.86	8.67
27	DEFICIT FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	TOTAL LIABILITIES	23.04	25.02	37.63	39.32	35.55	31.50	26.87	21.14	(1.22)	(1.04)
29	PREFERRED STOCK	0.00	(6.22)	(5.31)	(3.10)	(1.87)	(0.86)	(0.14)	(2.03)	0.00	0.00
30	COMMON STOCK	1.24	0.94	0.86	1.32	1.17	1.96	1.67	1.62	3.95	0.99
31	CAPITAL SURPLUS	10.16	28.32	24.77	17.61	16.29	14.58	13.57	16.45	7.13	(2.32)
32	RETAINED EARNINGS	66.67	52.10	50.22	56.83	56.18	57.43	60.83	63.63	(0.00)	0.35
33	TREASURY STOCK	(1.10)	(0.15)	(17.17)	(11.10)	(7.32)	(4.61)	(2.79)	(0.21)	(21.01)	1.68
34	TOTAL EQUITY	76.96	74.98	62.37	60.68	64.45	68.50	73.14	78.86	0.35	0.46
35	*TOTAL LIAB & EQUITY*	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	(0.00)
36	NET WORKING CAPITAL	49.60	41.57	27.60	27.30	36.68	40.07	45.97	45.16	(1.33)	1.51
INCOME & EXPENSES											
38	SALES	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	(0.00)
40	COST OF GOODS	54.85	52.39	49.23	47.88	47.71	47.97	49.93	51.97	(0.76)	(0.83)
41	GROSS PROFITS	45.15	47.61	50.77	52.12	52.29	52.03	50.07	48.03	0.88	0.91
42	S G & A EXPENSE	21.41	22.96	24.65	24.73	24.15	22.90	21.23	22.89	0.90	(0.20)
43	R&D EXPENSE	2.49	2.19	3.00	4.73	4.96	5.52	6.06	7.43	16.80	19.00
45	OPERATING PROFIT	21.25	22.46	23.13	22.67	23.18	23.60	22.78	17.71	(2.57)	(1.33)
46	DEPRECIATION	3.66	3.97	4.24	4.68	5.10	5.30	4.99	8.68	11.90	9.26
47	LEASE PAYMENTS	0.00	0.71	0.90	1.32	1.33	1.25	0.73	0.06	3.23	2.90
48	INTEREST EXPENSE	(0.48)	(0.39)	0.39	0.56	0.59	0.43	0.45	0.24	0.00	0.00
49	MISC EXPENSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	MINRTY INT IN ADJ SUBS	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53	PRETAX PROFIT	18.00	18.26	17.91	16.10	16.16	16.63	16.60	8.53	(10.10)	(6.77)
54	INCOME TAXES	7.76	8.12	7.56	6.62	5.76	6.13	5.50	3.07	(12.42)	(10.39)
55	EXTRAORDINARY ITEMS	(3.38)	0.00	(0.00)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	NET PROFIT	13.00	10.13	10.04	9.48	10.40	10.49	11.10	5.46	(12.31)	(6.62)
57	EPS AFTER PFD DIVIDENDS	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	(0.00)
58	COMMON DIV PER SHARE	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	(0.00)

Source: Dataquest
August 1986

Unitrode Corporation

Table 4

Unitrode Corporation
FUNDS FLOW HISTORY 1979-1986
(Millions of Dollars)

		Fiscal Year Ending January 31									
		1979	1980	1981	1982	1983	1984	1985	1986	CAGR	LSQR
SOURCES											
56	NET PROFIT	6.92	8.27	10.40	11.19	13.64	16.74	22.21	9.16	4.69	10.69
46	DEPRECIATION	1.85	3.24	4.39	5.53	6.68	8.45	9.98	13.57	32.93	29.51
61	NEW LONG TERM DEBT	0.00	0.00	8.20	0.30	2.91	3.94	3.73	3.43	0.00	0.00
62	NEW EQUITY	0.06	11.03	(12.87)	2.33	5.25	6.63	4.79	3.82	79.23	0.00
63	INCR OTHER LIABILITIES	1.81	1.33	3.67	10.15	1.12	(1.22)	(2.74)	0.52	(16.39)	0.00
66	TOTAL SOURCES	10.65	23.87	13.79	29.50	29.60	33.94	37.96	30.49	16.22	15.90
USES											
67	P P E EXPENDITURES	4.42	13.84	9.12	16.68	15.68	15.52	12.93	19.74	23.85	14.91
68	REPAYMENT LONG TERM DEBT	0.67	0.72	0.10	0.20	0.20	2.27	2.94	3.41	26.28	33.24
69	PREFERRED DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	COMMON DIVIDENDS	0.40	1.52	1.56	1.58	1.82	2.18	2.69	2.74	31.77	23.05
71	INCR OTHER ASSETS	0.47	1.82	2.20	5.33	(6.69)	0.00	(0.51)	5.78	43.21	0.00
72	INCR WORKING CAPITAL	4.70	6.76	0.75	(2.38)	18.78	13.92	19.93	1.56	(14.54)	0.00
74	TOTAL USES	10.65	23.87	13.79	29.50	29.60	33.94	37.98	33.23	17.66	16.73
75	EXCESS/DEFICIT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
76	CUMULATIVE SUR/DEF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: Dataquest
August 1986

Unitrode Corporation

Table 5

Unitrode Corporation
FINANCIAL RATIO HISTORY 1979-1986

		Fiscal Year Ending January 31									
		1979	1980	1981	1982	1983	1984	1985	1986	ST AVG	WT AVG
LIQUIDITY											
1	CURRENT RATIO	3.841	3.848	1.973	2.276	2.892	3.203	3.704	4.859	3.223	3.427
2	QUICK RATIO	2.352	1.954	0.972	1.185	1.490	1.550	1.859	2.213	1.647	1.683
3	CASH RATIO	1.086	0.540	0.143	0.264	0.521	0.338	0.471	0.485	0.479	0.429
4	WORKING CAPITAL/SALES	0.408	0.339	0.196	0.220	0.326	0.351	0.377	0.453	0.334	0.349
6	DAYS RECEIVABLES	67.462	61.184	60.961	57.959	60.868	70.440	70.617	74.208	65.450	67.287
7	DAYS INVENTORY	139.370	167.500	146.425	140.000	180.630	192.180	183.778	214.135	170.504	181.375
LEVERAGE											
8	LONG TERM DEBT/CAPITALIZ	0.018	0.000	0.000	0.002	0.010	0.010	0.017	0.009	0.009	0.010
11	LONG TERM DEBT/EQUITY	0.016	0.000	0.000	0.002	0.010	0.010	0.017	0.009	0.009	0.010
12	TOTAL DEBT/EQUITY	0.026	0.002	0.179	0.005	0.049	0.049	0.046	0.041	0.048	0.048
COVERAGE											
13	EBIT/INTEREST	(36.967)	(45.858)	45.582	29.701	28.164	39.672	37.917	36.912	16.899	29.623
14	FIXED CHARGE COVERAGE	85.722	58.533	13.733	9.539	9.401	10.884	15.037	8.758	26.451	15.827
16	REPAY LTD+FIX CHARGE COV	11.861	15.454	12.833	2.836	0.711	5.902	6.765	3.078	8.336	6.667
OPER PERFORMANCE											
17	GROSS PROFIT/SALES	0.452	0.476	0.500	0.521	0.523	0.520	0.501	0.480	0.498	0.503
18	OPER PROFIT/SALES	0.213	0.225	0.231	0.227	0.232	0.236	0.226	0.177	0.221	0.218
21	PRETAX PROFIT/SALES	0.181	0.183	0.175	0.161	0.162	0.166	0.164	0.085	0.160	0.149
22	NET PROFIT/SALES	0.137	0.101	0.100	0.095	0.104	0.105	0.111	0.055	0.101	0.094
23	NET PROFIT/AVG EQUITY	0.241	0.202	0.217	0.216	0.205	0.196	0.206	0.072	0.195	0.177
24	NET PROFIT/AVG CAPITALIZ	0.233	0.201	0.217	0.216	0.204	0.193	0.203	0.072	0.192	0.176
26	NET PROFIT/AVG TOT ASSETS	0.198	0.153	0.149	0.133	0.129	0.131	0.146	0.055	0.136	0.121
27	E P S GROWTH RATE	1.039	0.027	0.237	0.045	0.196	0.188	0.319	(0.595)	0.182	0.044
28	SALES GROWTH RATE	0.304	0.613	0.269	0.139	0.11	0.217	0.254	(0.161)	0.218	0.148
TURNOVER											
31	SALES/AVG EQUITY	1.758	1.993	2.166	2.279	1.975	1.870	1.857	1.329	1.983	1.835
32	SALES/AVG CAPITALIZ	1.763	1.980	2.168	2.277	1.983	1.843	1.824	1.312	1.983	1.817
33	SALES/AVG TOT DEBT + EQTY	1.691	1.971	1.993	2.108	1.927	1.789	1.773	1.273	1.819	1.758
34	SALES/AVG TOTAL ASSETS	1.392	1.509	1.488	1.488	1.239	1.246	1.318	1.018	1.324	1.262
35	SALES/AVG OPER ASSETS	1.493	1.685	1.591	1.568	1.341	1.294	1.358	1.055	1.412	1.337
36	SALES/AVG GROSS P P E	2.592	2.892	2.848	2.375	2.084	2.029	2.178	1.577	2.294	2.115
BALANCE SHEET											
37	CASH/SALES	0.153	0.089	0.029	0.046	0.098	0.054	0.066	0.057	0.073	0.064
38	RECEIVABLES/SALES	0.188	0.168	0.167	0.159	0.167	0.193	0.193	0.203	0.179	0.184
41	INVENTORY/SALES	0.269	0.240	0.197	0.184	0.236	0.253	0.251	0.306	0.235	0.248
42	OTH CURR ASSETS/SALES	0.006	0.007	0.004	0.005	0.005	0.010	0.006	0.005	0.006	0.006
44	GROSS P P E/SALES	0.429	0.425	0.420	0.473	0.543	0.540	0.491	0.683	0.501	0.536
45	LINE 13/SALES	0.016	0.042	0.032	0.027	0.024	0.019	0.015	0.041	0.027	0.027
46	MISC ASSETS/SALES	0.037	0.083	0.026	0.009	0.012	0.011	0.006	0.019	0.023	0.020
47	ACCOUNTS PAYABLE/SALES	0.048	0.072	0.048	0.078	0.052	0.045	0.038	0.033	0.051	0.047
48	ACCRUED TAXES/SALES	0.040	0.047	0.018	0.027	0.034	0.033	0.021	0.004	0.029	0.023
51	ACCRUED LIABILITY/SALES	0.044	0.018	0.022	0.025	0.028	0.032	0.040	0.036	0.030	0.032
53	DEFERRED TAXES/SALES	0.011	0.012	0.018	0.023	0.028	0.032	0.024	0.036	0.023	0.027
54	MISC LIABILITIES/SALES	0.025	0.020	0.048	0.121	0.110	0.074	0.046	0.051	0.063	0.067
56	LINE 26/SALES	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MISCELLANEOUS											
57	EQUITY PER COMMON SHARE	3.088	4.441	4.823	4.769	5.988	7.235	8.926	9.951	6.646	7.177
58	RETIRE/PREV GROSS P P E	0.000	(0.030)	(0.009)	(0.100)	(0.007)	(0.000)	(0.000)	(0.033)	(0.026)	(0.025)
61	DEPREC/PREV GROSS P P E	0.107	0.149	0.126	0.127	0.120	0.119	0.118	0.138	0.125	0.126
62	COM DIVS/ERN+PFD DIVS	0.057	0.184	0.149	0.142	0.119	0.130	0.121	0.299	0.158	0.168
63	TAX RATE	0.438	0.445	0.432	0.411	0.358	0.369	0.331	0.368	0.392	0.374
64	COST OF GOODS/SALES	0.548	0.524	0.492	0.479	0.477	0.480	0.499	0.520	0.502	0.497

Source: DATAQUEST
August 1986

4. Operations

4.1 Lines of Business/Revenue

Unitrode and its subsidiaries are engaged in one line of business and operate predominantly within the single industry of semiconductors.

In semiconductors, Unitrode manufactures a comprehensive line of diodes, rectifiers, power transistors, and analog ICs. Its analog ICs represent approximately $10 million in revenues in a $1 billion market that is growing by more than 20% annually. These chips are used in switching power supplies and electric motors, and can also be used to control electrical variance and the speed/position/power consumption of AC and DC motors. Unitrode's high performance, highly reliable power discrete semiconductors represent over $70 million in revenues from a diverse base of specialty applications in a market that is growing by over 10% annually. Recently, Unitrode has been concentrating on a specialty area called power MOSFETs (also known as smartpower chips) which are used in a wide range of electronic products. Although MOSFETs currently represent less than $4 million in revenues, this market is estimated to grow 45% annually.

4.2 Semiconductor Revenue as Percentage of Total

(Fiscal years ending January 31)

Product Category	1982	1983	1984	1985	1986
Semiconductors	60%	53%	50%	52%	55%
Capacitors	18	21	21	17	12
Data Conversion Devices	16	14	13	14	14
Switching Power Supplies	6	12	16	17	19
	100%	100%	100%	100%	100%

4.3 Manufacturing Locations/Plans

Domestic:

Name	Location	Function	Size per 1000 sq. ft.
Unitrode Corporation	Lexington,MA	Executive Offices	162.0
" "	San Diego,CA	Capacitor	33.9
US Microtek Components	Sun Valley,CA	Ceramic Capacitors	50.0
Unitrode Corporation	Westbrook,ME		43.6
Powercube	Billerica,MA		22.0
Power General	Canton,MA	Switching Power Supplies, Converters	57.2
Unitode Corporation	Methuen,MA		30.0
" "	Watertown,MA		162.0

Micro Networks	Worcester,MA		83.0
Unitrode Corporation	Merrimack,NH	Linear ICs	55.1
" "	Haverhill,MA		16.0
" "	Stoughton,MA		6.4
International:			
Unitrode Corporation	Shannon, Ireland		10.0
" "	Ennis, Ireland		45.8
" "	Agua Prieta, Mexico		16.0
" "	Chihuahua, Mexico		47.3

4.3 Capital Spending/Research and Development

Unitrode has 161 professional employees engaged full time in research and development activities.

R&D Expenditure:

FY 1985 $12,472,000.
FY 1984 $12,124,000.
FY 1983 $ 8,813,000.

5. Market Analysis

5.1 Sales/Market Share by Product Category

(Please refer to Final Market Share Estimates)

5.2 Market Share and Growth

(Please refer to Final Market Share Estimates)

5.3 Major Competitors

Unitrode's major competitors in the discrete semiconductor and linear IC product lines are listed below:

1) Motorola
2) General Instrument
3) International Rectifier
4) Sprague
5) National Semiconductor

5.4 Marketing Strategy

Unitrode seeks to introduce one new power management circuit a month, and it ranks as a leader among US suppliers of linear circuits for power supplies and motor controls. Using standard bipolar as well as CMOS and DMOS process technologies, Unitrode works closely with its power management customers to design and develop proprietary products. The markets are defined by addressing the specific needs of a single user in conjunction with broader applications by other users, focusing on new combinations of speed, high-voltage, and high-current capabilities.

5.5 Market Leadership Positions

Analog ICs represent Unitrode's most rapidly growing product group. Including hybrids, North American revenues of $28 million accounted for more than 20 % of the Company's 1985 worldwide semiconductor business.

5.6 Channels of Distribution

During fiscal year 1985, about 10,000 customers were served by Unitrode. The Company's ten largest customers accounted for approximately 19% of its business with no one customer accounting for more than 3% of sales. Sales directly to the US government or its agencies was approximately 1%.

Unitrode's products are marketed on an international basis by independent manufacturers' representatives, company salesmen and also several distributors. Unitrode maintains regional sales offices in eight states and utilizes an extensive distributor network throughout the US. Internationally, the Company's products are marketed manufacturers' representatives and distributors in Canada, Israel, Japan, Germany, France, the United Kingdom and other European and Far Eastern countries.

Export sales are also made directly to foreign subsidiaries of certain US companies. Unitrode has subsidiaries in Germany, Italy, the United Kingdom, Hong Kong, the Netherlands, and Ireland.

5.7 Major Applications

Products manufactured by Unitrode are used in computers, computer peripheral equipment, process control systems, instrumentation and telecommunication equipment as well as recreation, home safety and transportation products. Its products are also used in major missile and defense programs in such applications as navigation, electronic countermeasures, and radar, control, or airborne computers.

5.8 Export vs. Domestic

Total Foreign and U.S. export sales were reported as follows:

(Fiscal Years ending January 31)

	1984	1985	1986
Sales Amount	$ 11,400,000	$13,000,000	$15,600,000
Percent of Total Sales Revenue	19%	17%	17%

6. Products and Technologies

6.1 Key Products

DISCRETE SEMICONDUCTORS:

The primary application for Unitrode's discrete semiconductors is in switching power supplies. In this area there is an overall trend toward higher densities and despite the current slump in the semiconductor industry Unitrode allocated considerable research and development efforts to address this trend.

The same customers designing these power supplies require advanced, faster high-voltage rectifiers for which Unitrode has introduced a new product line using a new metal diffusion process and die passivation techniques.

Unitrode offers a family of devices which address the area of transient voltage suppression (TVS) primarily for military applications. Other products designed for the military include rectifiers, transistors, and zeners in hermetic surface mount packages as well as leadless chip carriers.

Recently, Unitrode developed the BISYN which operates at lower than 3.3 volts to fulfill a growing need for low voltage rectifiers.

CERAMIC CAPACITORS AND EMI FILTERS:

In fiscal year 1986 Unitrode re-aligned its capacitor business by relocating manufacturing to the Chihuahua, Mexico facility. The Company is particularly strong in capacitors for use as output filters for switching power supplies and as input filters for DC/DC converters.

Unitrode has taken advantage of its inter-divisional expertise in hermetic packaging, ceramic and power switching supply. As a result the US Microtek division has introduced a new line of hermetically sealed filters. In addition US Microtek is the only manufacturer qualified to fulfill military specification MIL-F-28861 for the newly developed hi-rel EMI/RFI filter.

DATA CONVERSION DEVICES:

Linear ICs for use in data conversion devices have been developed by Unitrode. This is the second segment of Unitrode's linear business. The Company entered this market by acquiring Micro Networks in 1979. This subsidiary earned its reputation among military and industrial customers for state -of-the-art, thin-film hybrid circuits. Products like the 12-bit, Multiplexed Data Acquisition System and the Floating Point 20-bit analog-to -digital converter reflect the strategic focus on leading-edge, value-added devices. For the future, Unitrode aims to increase its penetration of the military and industrial markets for monolithic data converters.

ANALOG INTEGRATED CIRCUITS:

Unitrode sells linear products targeted for power management applications. These analog ICs either control the operation of switching power supplies or modulate the speed, position, and power consumption of AC and DC motors. This segment represents the firms most rapidly growing product line. Unitrode seeks to introduce one new power management circuit a month, and it ranks as a leader among US suppliers of linear circuits for power supplies and motor controls. Using standard bipolar as well as CMOS and DMOS process technologies, Unitrode works closely with its single user in conjunction with broader applications by other users, focusing on new combinations of speed, high-voltage, and high-current capabilities.

SWITCHING POWER SUPPLIES:

Products in this area are produced by Unitrode's two subsidiaries Powercube and Power General. Powercube's products are primarily for military applications with one the most notable products being the ICECUBE (TM). The ICECUBE is a modular power supply system using current node control switching and power MOSFETs. A newer version of the ICECUBE was introduced in 1985 that conforms to the European standard for card mounted power supplies.

Power General addresses the commercial market segment with end users such as automated test equipment, engineering work stations, and other computerized subsystems. Power General is quick to get new products out on the market, and is expected to offer more than a dozen new products each year.

6.2 Second Source and License Agreement

In 1983 Unitrode announced a second source agreement with SGS of Italy. The agreement allows Unitrode to produce three of SGS's high power linear ICs, the SGS L292 switchmode DC motor driver, the L293 dual bridge motor driver and the L295 dual switchmode solenoid driver. For SGS, it now has the right to produce five of Unitrode's most popular devices from the Company's range of switch mode power supply chips.

During the same year Unitrode also entered into a technical license agreement with International Rectifier Corporation for IR's HEXFET. Power MOSFET and the companies will cross-license each other's future MOSFET developments.

6.3 Product/Technology Highlights

During 1986 Unitrode set a record introducing at least one new product each month. A list of these new items is provided below:

- Sept. 1986 - New low voltage power Schottky rectifier USD7520/7525

- July 1986 - Largest family of ultra-efficient TO-247 rectifiers

- May 1986 - 4200 series High performance quad output 200 watt switching power supply

- April 1986 - 740 series ultra wide input range high efficiency DC-DC Converters

- March 1986 - MN6227/MN6228 A/D Converters

- Feb. 1986 - 540 Series Ultra-Miniature regulated 1 watt DC-DC Converters

- Feb. 1986 - New single ended 1 MHz Controller

- Feb. 1986 - Temperature and Airflow sensor IC Series

- Jan. 1986 - 1.5 MHz Switch Mode DC-DC Power Supply Converter

7. Non-Semiconductor Products Summary

Unitrode's entire product line is within the scope of the semiconductor industry.

8. Dataquest Analysis

8.1 Long-term Outlook

Unitrode has a strong foothold in the power discretes or MOSFETs markets, which are less cyclical and less susceptible to the current industry environment. Dataquest expects MOSFETs to be a major contributor to long-term revenue growth. These products afford higher profit margins, and they should have an immediate impact on the bottom line.

8.2 Challenges to Overcome

A drop-off in the US capacitor business has brought revenues down in recent years. Unitrode must try to make up for this loss in other areas.

In the data conversion area Unitrode must make efforts to keep pace with Harris and Analog Devices among other firms.

8.3 Opportunities

In analog and discrete power management Unitrode has a good basis for moving into smartpower ICs. Dataquest believes Unitrode has the potential to be successful if they were to specialize in the power arena. However, National and Motorola could impose increased competition in the power IC area and become a threat to Unitrode's niche market.

8.4 Strengths and Weaknesses (excluding technology)

Unitrode operates in specific market niches for semiconductor and other electronic products and has remained profitable throughout 1985's slump in the semiconductor industry.

Unitrode offers a wide range of products and frequently exploits technology which is transferable from one division to another. Also, Unitrode's customer base is common to several divisions and therefore strengthens the Company's customer contact and channels for sales and distribution.

Dataquest expects solid growth in orders and revenues (over 50% by the end of FY 1988) due to the Company's strong position in the military/aerospace and proprietary non-military markets.

UNITRODE SUBSIDIARY OFFICES

MICRO NETWORKS CORPORATION

324 Clark Street
Worcester, MA 01606
Telephone: (617) 852-5400
TWX: 710-340-0067

Corporate Office

Door 7, Lakeside Office Park
North Avenue
Wakefield, MA 01880
Telephone: (617) 245-3403
TWX: 910-495-1769

Don Poulliot
Regional Manager,
Northeast

POWERCUBE CORPORATION

8 Suburban Park Drive
Billerica, MA 01821
Telephone: (617) 667-9500
TWX: 710-347-6792

Corporate Office

Door 7, Lakeside Office Park
North Avenue
Wakefield, MA 01880
Telephone: (617) 245-3404
TWX: 910-495-1769

Bill Elswick
Regional Manager,
Northeast

15011 Parkway Loop
Suite F
Tustin, CA 92680
Telephone: (714) 730-7753/7754
TWX: 910-595-1999

Lorraine Sampson
Regional Manager,
West Coast

POWER GENERAL

152 Will Drive P.O. Box 189
Canton, MA 02021
Telephone: (617) 828-6216

Corporate Office

U.S. MICROTEK COMPONENTS

11144 Penrose
Sun Valley, CA 91352
Telephone: (818) 767-6770
TWX: 910-498-4988

Corporate Office

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RESEARCH NEWSLETTER

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SMART POWER ICs: TECHNOLOGICAL EVOLUTION WILL CREATE $2 BILLION OPPORTUNITY BY 1990

OVERVIEW

The stream of new product announcements and trade articles about smart power ICs reflects the early results of a technology and processing race that began around 1982 as discrete semiconductor manufacturers, linear IC houses, and start-up companies first sought to establish long-term positions in this nascent market. These firms and other recent entrants are eagerly and aggressively tapping into a total available market for smart power ICs that stands, excluding hybrid packages, at $0.9 billion in 1986 (although actual sales will be far less because all possible applications will not be immediately achieved), and that should grow to $1.95 billion by 1990 (again, actual sales will be less, but closer to the full target market). As we will discuss, including hybrids would enlarge the total available market by $300 million in 1986 and $500 million in 1990.

Although actual consumption will fall short of the total available market for sales, the raw magnitude of the business makes the smart power IC a key element in strategic plans for companies ranging from start-ups like Integrated Power Semiconductor and Maxim Integrated Products to industry giants like General Electric, Motorola, and Texas Instruments. Smart power chips will be an impact product for semiconductor manufacturers as well as for users (like us) of equipment that incorporate these chips, both at home and in industry. Although smart power represents more of an evolution than a revolution in semiconductor technology, the stakes are huge because the winners in this competition will earn millions of dollars in revenue during the next decade and, in the process, virtually assure themselves of a continuing role in an expanding segment of the semiconductor industry well into the 1990s.

Manufacturers continue to disagree about the definition of a smart power IC. As a working definition, Dataquest defines a smart power IC as a device that combines logic and/or analog circuitry with power-handling capabilities on a monolithic chip. We realize that no definition is as

yet perfect in this young market: voltage regulators meet the strict definition of a smart power IC, and, in fact, smart power devices have been available in hybrid packages for years. The focus on the monolithic chip, however, spotlights an economic reality that in turn affects engineering design decisions: monolithic ICs lend themselves to low-cost volume production (compared with the more expensive hybrid packages), and the availability of less expensive parts typically accelerates new product design-ins and thus the rate of growth in consumption (as in the case of power MOSFETs).

The smart power IC business is not for all companies, and many successful semiconductor manufacturers of the next decade will not produce these chips. Even so, smart power ICs represent a genuine opportunity for merchant suppliers of discrete semiconductors and linear integrated circuits, for certain captive producers of semiconductors, and for start-ups that can devise specialized products or unique technologies. Semiconductor manufacturers interested in smart power technology face a host of tough strategic issues. For those thoroughly committed to the smart power market, strategic plans must be carefully reexamined with an eye to issues like the continuing vitality of the original product/technology choices, the impact of competitors' advances (or delays), growth prospects in application markets, newly discovered opportunities in terms of both specific products and broad business segments, and joint venture arrangements. As for those that have not yet entered the smart power IC business, the obvious "market entry" question becomes a matter of determining which segments or niches can support new entrants, how long the windows of opportunity will remain open (if not already closed), and whether the would-be entrant should develop its technology and products alone or else by way of a joint venture, technology transfer, or similar route.

For consumers as well as industrial producers, the smart power products made possible by these ICs will change the way we work just as microcomputers changed our ways of thinking and computing. Smart power ICs are going to have tremendous impact on personal life as well as commercial industry. Right now, microprocessor-based systems process information for us, but smart power chips extend the computer revolution a big step by enabling these systems to perform actual work. Smart power marks a fundamental change in the control and operation of electrical power. The impact of these power chips will be seen first in the home, automobile, and factory during the next two years as products like smart home appliances, automotive systems, and robotic factory controls move from the drawing board to end-market applications. The smart power chip market is still quite young, however, and the full impact of these ICs will not be felt until the 1990s, when the smart car, smart house, and smart factory become firmly integrated into our way of life.

To gauge demand for a given chip, smart power IC vendors need to know not only the magnitude of this market and its segments but also the consumption forecasts for a variety of application markets. Dataquest segments the smart power IC market on the basis of IC electronic characteristics (i.e., voltage and current) and then analyzes the forecasts for growth in relevant application markets. This approach provides a framework of analysis for companies already participating in or considering entry into the smart power IC business.

This newsletter addresses primarily the first issue--the overall magnitude of the smart power IC market--based on the prospects for growth in the critical end markets (i.e., application markets). This newsletter does not present a forecast of smart power IC consumption, but rather a measurement of the potential market (total available market) for these chips. Again, the focus will be on monolithic smart power ICs, with a separate discussion of the hybrid segment.

SMART POWER IC SUBMARKETS

To begin, Tables 1 and 2 summarize the two segments of the emerging market that most readily lend themselves to monolithic chip production. Based on industry discussions, Dataquest refers to these submarkets as "medium-power ICs" and "high-power ICs." The lists of product applications and competitors should be considered as representative, and not exhaustive.

Tables 1 and 2 also provide estimates in dollars of the total available market for smart power ICs in 1986 and 1990--which includes portions of the discrete semiconductor and linear IC markets vulnerable to displacement by smart power chips.

Medium-Power ICs

The first submarket for smart power applications is the medium-power segment. As can be seen from Table 1, all applications for medium-power ICs used to be served by discrete components. However, as the demand for digital switching technology for telephone systems and data transmission became more prevalent, digital chip engineers began devoting effort to these smart power ICs. The ICs needed for these telecommunication applications require voltages in excess of 100 volts and low currents of less than 100 milliamperes. Similarly, flat-panel display developers were looking desperately for lower-cost electronic row-and-column driver ICs. The same electrical environment existed for these display driver ICs as for telecommunications switches, so the developers of high-voltage, low-current switches also worked to develop display driver ICs. Much of the attention to smart power ICs has focused on the medium-power segment of the market.

High-Power ICs

The second submarket for smart power applications is the high-power IC segment. High-power ICs are needed to provide high currents of up to 10 amperes to drive small motors, operate power supplies, and regulate power. Closely tied to growth in the factory automation, industrial, and transportation markets, the high-power IC segment should become the mainstream of the smart power market by 1990, although few products exist as of 1986. Because these high-power chips do not lend themselves easily to commodity production, niche market opportunities will be available for producers in this segment. Table 2 describes the high-power IC market.

Table 1

ESTIMATED MEDIUM-POWER IC SUBMARKET

Total Available Market*	Application	Electronic Characteristics	Competitors
1986--$400M	Display drives	To 200 volts	Siliconix
1990--$750M	Telecom switches	To 100 milliamps	Sprague
CAGR 17%	High-voltage SLIC	output	Texas Instruments
	Very small DC-DC	To 5 watts	Maxim
	converters	dissipation	Motorola

Table 2

ESTIMATED HIGH-POWER IC SUBMARKET

Total Available Market*	Application	Electronic Characteristics	Competitors
1986--$500M	DC motor drives in	To 400 volts	Integrated Power
1990--$1.2B	computer/office	To 10 amperes	SGS
CAGR 24%	peripherals,	output	Sprague
	automobiles	To 50 watts	Hitachi
	AC motor control in	dissipation	Unitrode
	robotics,		Silicon General
	industrial controls		
	Power regulation		
	Power supervision		

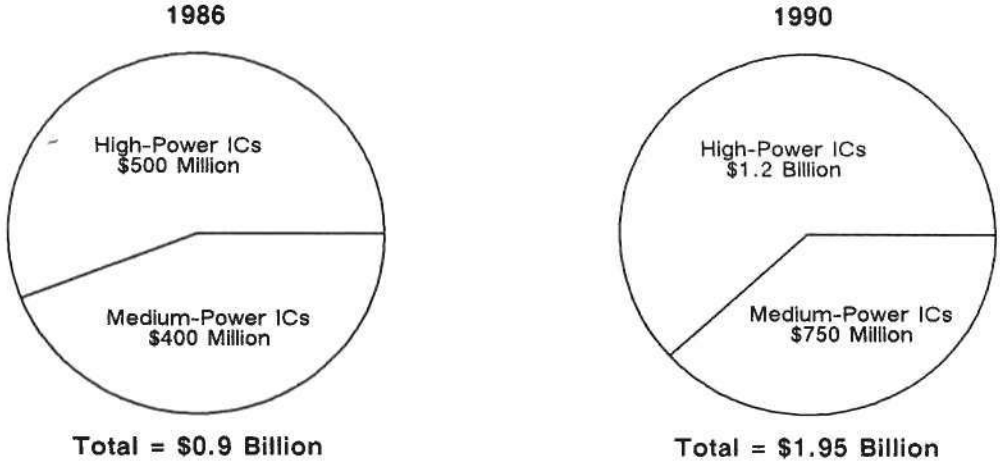
*Represents linear and discrete semiconductor markets vulnerable to displacement by smart power products, not necessarily the total market that will be served.

Source: Dataquest
October 1986

Figure 1 describes the 1986 and 1990 total available markets for smart power ICs (excluding hybrids).

Figure 1

ESTIMATED TOTAL AVAILABLE MARKET FOR SMART POWER ICs (Excludes Hybrids)



Source: Dataquest
October 1986

Our analysis of the total available market for smart power ICs shows that the basis exists for booming sales, but a host of problems must be solved before the $10-million market of 1985 can become the billion-dollar market of the 1990s. As of yet, few smart power chips are available in the marketplace, and only then at very high prices. General Electric is a major consumer of smart power ICs, but most of its needs are supplied internally. Design engineers need time to become familiar with the new ICs before demand will grow. The process by which engineers take a new chip and adapt it for commercial, industrial, and military use involves the kind of experimentation that eventually leads to a series of both anticipated and unforeseen product applications.

Technological limitations--such as the constraints faced in combining so much power in such close proximity to sensitive logic functions, or the fact that high-current capability means a sacrifice in chip space (except for the expensive hybrid package approach)--could thwart the development of monolithic smart power ICs for very high power applications. At the present time, with several exceptions, only hybrids can meet the demand for applications requiring more than 400 volts, more than 10 amps, and more than 50 watts of dissipation. Unless the challenging technical barriers are overcome, no monolithic smart power ICs will be developed to serve this potential niche of the market.

Very High Power Discretes

A third potential submarket for smart power applications is that of discrete power transistors. Table 3 provides an estimate of the total available market for very high power smart power chips should the technological barriers be overcome regarding monolithic chip products. Some manufacturers of discrete components have participated in the smart power motor-drive market by marketing their discretes in hybrid form with four or more separate chips inside the package. Such hybrids are too expensive, however, for motor-drive applications in computer peripherals, office products, and automobiles. Table 4 describes the very high power discrete market.

Vendors of smart power ICs must deal with tremendous pricing pressures. Some of the targeted end markets (e.g., computer peripherals and automotive electronics) are analogous to the consumer electronics market, and the typically aggressive pricing in those markets foretells low average selling prices for many smart power IC suppliers, especially those in the medium-power segment. Except for the huge volume producers like Hitachi or Motorola, producers will be hard pressed to recover the high costs of new IC development, and it will certainly not happen over a short period of time.

Table 3

ESTIMATED VERY HIGH-POWER DISCRETE MARKET

Total Available Market*	Application	Electronic Characteristics	Competitors
1986--$300M 1990--$500M CAGR 14%	Large DC motor drives Large AC motor drives Power supply outputs	To 100 amps output To 1,500 volts To 100 watts dissipation	Motorola General Electric RCA Toshiba Ixys Siemens General Instrument Siliconix Texas Instruments Int'l Rectifier

*Represents linear and discrete semiconductor markets vulnerable to displacement by smart power products, not necessarily the total market that will be served.

Source: Dataquest
October 1986

DATAQUEST CONCLUSIONS

Beyond the considerations discussed above, there is always the risk of unexpectedly slow growth in application markets. Part of the 1986 spotlight on the smart power market stems from a somewhat misguided belief that there already waits an application for each smart power chip in the same way that there does seem to be an existing or soon-to-be-discovered application for every power MOSFET. The critical, unresolved question becomes a high-tech version of the "chicken or the egg" puzzle: which comes first--the egg (the smart power IC) or the chicken (the product application, such as a flat-panel display)? That is, will the availability of a smart power chip lead to a boom in sales of a given smart product (e.g., high-voltage subscriber line interface circuits), or will the demand for the smart power IC remain strictly keyed to growth in the application markets? In the early growth stages of this marketplace, demand for smart power ICs will be closely linked to end-market demand, and only over time will the chips themselves lead to new applications and growth opportunities. In other words, for the short term, smart power IC manufacturers must know their targeted end markets as well as they know the semiconductor business.

Producers of smart power ICs confront a total available market of $0.9 billion in 1986 that will more than double to $2 billion by 1990 (excluding hybrids). But they will capture only a small portion of this year's total available market. Today's efforts by producers like General Electric, Integrated Power Semiconductors, Maxim, Motorola, Siliconix, and Texas Instruments puts those firms in a good position to capture a healthy share of the total available market in the future. A host of would-be suppliers will face more constrained opportunities, but the supplier base is far from settled. Strategic planning will focus as much on application market analysis as on assessments of the smart power IC market. As noted, over the long-term, new product applications will spring forth for smart power ICs, especially as prices decline. But in the short haul, vendors of smart power chips must closely track developments in the end markets.

Ron Bohn